8810A
Digital Multimeter

Instruction Manual

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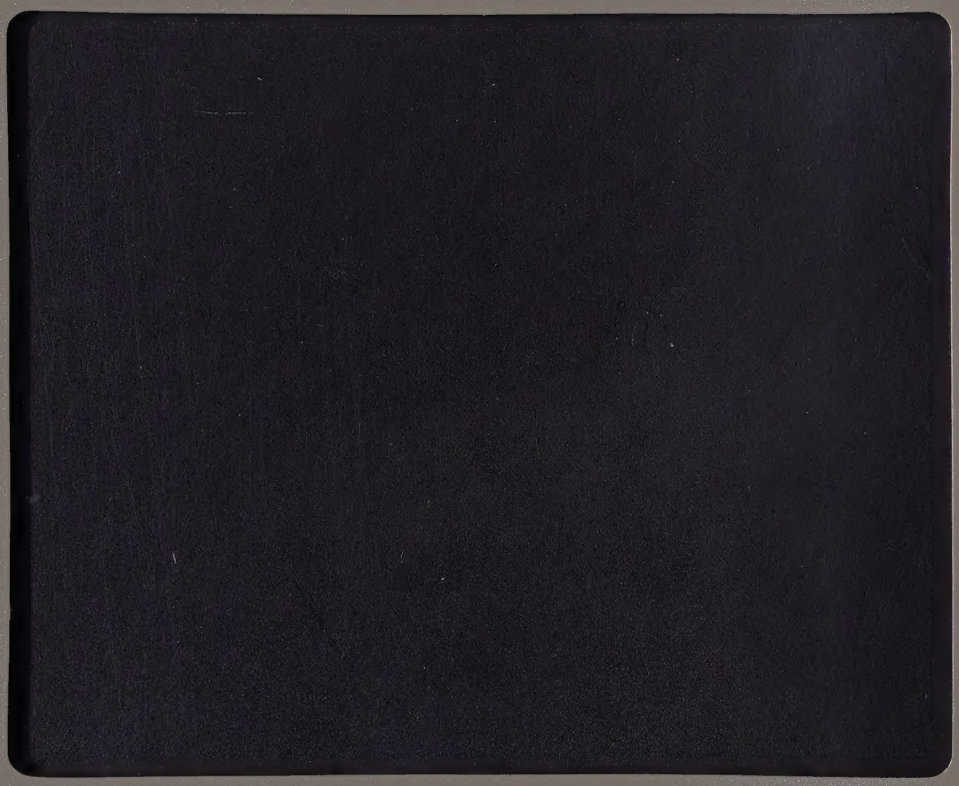

NOTE

This manual documents the Model 8810A and its assemblies at the revision levels shown in appendix 7A. If your instrument contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies, or to the backdating sheet in appendix 7A for older assemblies.

8810A

Digital Multimeter

Instruction Manual

P/N 472472
February 1978

FLUKE®

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*For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

Rev. 6/81

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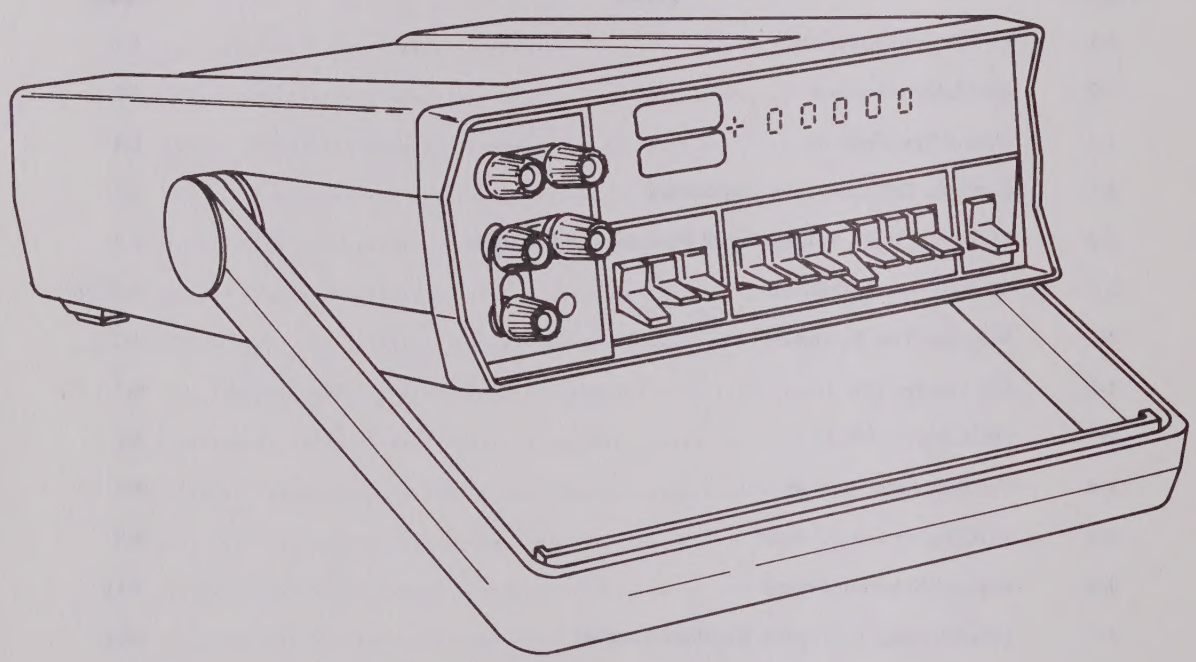


8810A Digital Multimeter

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 8810A is a 5½-digit, fully guarded digital multimeter designed for use in bench-top or rack mounted applications. It features five dc voltage ranges, autoranging, dual-slope a/d conversion, auto polarity, overload protection, and an automatic display-overload indication.

1-3. DC voltage measurement capabilities include five ranges from 200 mV to 1200V with a maximum sensitivity of 1 μV. Circuit loading is virtually eliminated on the 200 mV, 2V and 20V ranges by an input resistance $> 10^9$ ohms. The resistance is $10^7\Omega$ on the 200V and 1200V ranges. Each range can be manually selected by depressing an appropriate front panel range switch. Autorange can also be manually selected as a range. It offers convenient operation plus optimum accuracy and resolution when frequent range changes are required. All dc voltage ranges will withstand the continuous application of inputs up to 1000V dc or 1100V peak ac.

1-4. Measurement data is displayed on a 5½-digit LED readout. The readout is continuously updated and includes decimal point, polarity (Vdc only) and a 200 mV dc range annunciator (20 MΩ and 200Ω annunciators are also included for use with the Ohms Converter Option). When a range overload occurs (full scale count of 199999 is exceeded) the display will flash 188888 as an overload indication.

1-5. Measurement capabilities of the 8810A can be increased by the addition of one or more of the available options and accessories listed in Table 1-1. All options, with the exception of the Digital Output Unit, are field installable by the user, if calibration facilities are available. Options may be ordered at time of purchase or at a later date. The basic 8810A will accommodate 1 - Ohms Converter Option, 1 - AC Converter Option and/or 1 - Digital Output Unit. All available options and accessories are described in detail in Section 6 of this manual.

Table 1-1. Options and Accessories

MODEL OR OPTION NUMBER	DESCRIPTION
M00-200-625	Rack Mounting Kit
A80	Deluxe Test Lead Kit
80K–40	High Voltage Probe
82RF	High Frequency Probe
81RF	High Frequence Probe
80T–150	Temperature Probe
–002	Digital Output Unit 1
–007	Ohms Converter 2
–008	AC Converter 2
–009	True RMS Converter 2

1 Must be installed at factory or service center.

2 Field installable if calibration facility is available.

1-6. The 8810A is available in two line power configurations, 115/230V ac, 50 or 60 Hz; or 100V ac, 50 Hz. A slide switch allows voltage selection for the 115/230V ac model.

1-7. SPECIFICATIONS

1-8. Specifications for the 8810A and its available options are given in Tables 1-2 and 1-3, respectively. Accessory specifications are included in Section 6 of this manual.

1-9. Accuracy specifications for the 8810A are stated as ± (x% of input +y% digits of error), where

x is the input signal measurement accuracy and y is instrument error with no input signal. For example: assume a 10V dc input (10000 digits) on the 20V dc range. The stated accuracy is ±(0.005% of input +2 digits). Calculation yields an overall accuracy of ±(0.005% of 10000 digits +2 digits) = ±(5 + 2) = ± (7 digits). Therefore, for an absolute 10V dc input the 8810A will read between 9.9993 and 10.0007.

Table 1-2. 8810A Specifications

DC VOLTAGE	
Ranges	±200 mV, ±2V, ±20V, ±200V, ±1200V
Accuracy	
24 Hour, 23°C ±1°C	
200 mV range	±(0.008% of input + 5 digits)
2V–200V range	±(0.005% of input + 2 digits)
1200V range	±(0.005% of input + 4 digits)
90 days, 18°C–28°C	
200 mV range	±(0.01% of input + 10 digits)
2V–200V range	±(0.01% of input + 3 digits)
1200V range	±(0.01% of input + 6 digits)
Temperature Coefficient	
0°C–18°C, 28°C –50°C	
200 mV range	±(0.0007% of input + 3 digits) /°C
2V range	±(0.0007% of input + 1 digit) /°C
20V–200V range	±(0.0007% of input + 1 digit) /°C
1200V range	±(0.0007% of input + 1 digit) /°C
DC Input Resistance	
200 mV–20V range	≥1000 megohms
200V–1200V range	10 megohms
Normal Mode Noise Rejection	≥60 dB @ 50 Hz and 60 Hz
Common Mode Noise Rejection	≥120 dB @ dc to 60 Hz (with 1 kΩ in either lead)
Resolution	1 μV on 200 mV range
Ranging	Full autoranging or manual ranging
Polarity	Automatic bipolar, + or – display
Overload Protection	200V, 1200V range; ±1200V dc, 1700V peak ac 200 mV–20V range; ±1000V dc, 1400V peak ac
Offset Current (at 23°C)	Less than 15 pA on any range. Temperature coefficient of ±5 pA/°C
Zero Stability	Better than 10 μV for 90 days after 1 hour warm-up
Response Time to Rated Accuracy within Range	1 second maximum to displayed input
ENVIRONMENTAL	
Storage Temperature	–40° C to 75° C
Operating Temperature	0° C to + 50° C
Humidity Range	70% R.H., + 35° C to +50° C 80% R.H., +5° C to +35°C

Table 1-2. 8810A Specifications (cont)

GENERAL	
Function	Selected via front panel controls
Range	Full autoranging or manually selectable via front panel controls
Autorange Rate	600 ms maximum per range change
Display	7 segment 0.3" LED display, automatic decimal location
Reading Rate	2.5 readings per second, within the same range
Overload Indication	Flashing Display of +188888 (built-in segment test of LED display) for out of range indication
MTBF	10,000 hours calculated, minimum
Maximum Common Mode Voltage	1000V dc or peak ac
Maximum LO to GUARD Voltage	100V dc or peak ac
Power	110/230V ac ±10%, 50 or 60 Hz or 100 Vac ±10% 50 Hz, 8 watts
Size	Maximum dimensions (see Figure 1–1) 8,03 cm x 22,86 cm x 36,07 cm (3.16 " high x 9.0" wide x 14.2" long)
Weight	3.0 kg (6.5 pounds)

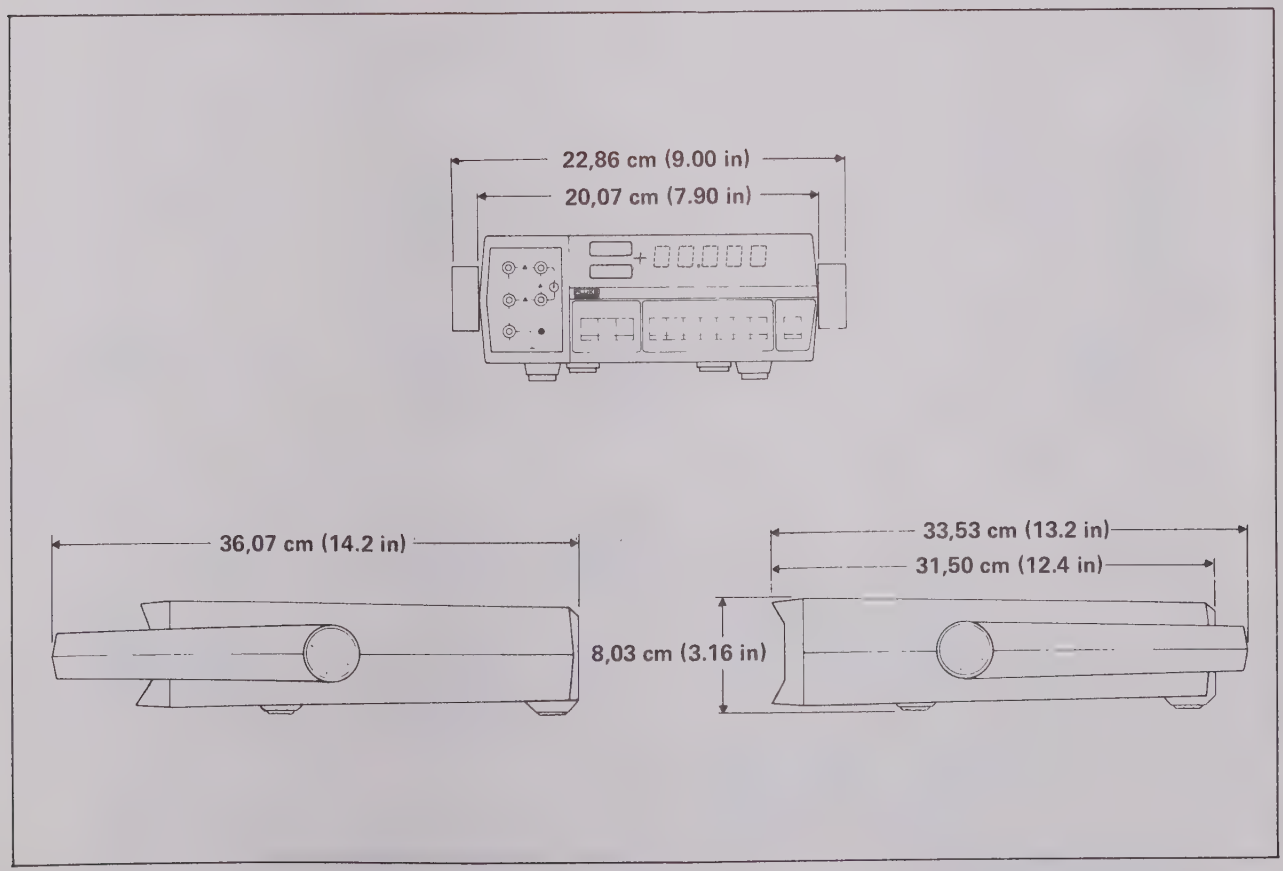


Figure 1-1. Model 8810A Outline Drawing

Table 1-3. Option Specifications

Option –002
Data Output Unit

Available Data	Digits, Polarity (both logic Senses), and Range.
Data Output (form)	Isolated BCD, with compatible TTL/DTL levels.
Data Coding	8–4–2–1 BCD positive-true parallel (negative-true easily obtained by changing output buffers).
Logic Levels	"1" = +5V, "0" = 0V
Drive Capability	All outputs can drive a minimum of two TTL loads, (i.e., sink 3.2 mA).
Flags	Busy, not Busy, and Overload
Controls	External trigger (negative-going edge triggers); External trigger enable (Logic "1" enables external, trig. Logic "0" causes data update at the internal sample rate of approximately 2.5/second); +5V reference.

Option –007
Ohms Converter

Ranges	200Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2000 kΩ, 20 MΩ
Resolution	1 mΩ on 200Ω range
Configuration	Four-terminal measurement on all ranges
Ranging	Full autoranging or manual range
Accuracy	
(24 Hour, 23°C ±1°C)	
200Ω range	±(0.01% of input + 5 digits)
2 kΩ–200 kΩ range	±(0.008% of input + 2 digits)
2000 kΩ range	±(0.02% of input + 2 digits)
20 MΩ range	±(0.05% of input + 2 digits)
(90 day, 18°C–28°C)	
200Ω range	±(0.02% of input +10 digits)
2 kΩ–200 kΩ range	±(0.01% of input + 3 digits)
2000 kΩ range	±(0.05% of input + 3 digits)
20 MΩ range	±(0.2% of input + 3 digits)
Temperature Coefficient	
200Ω range	±(0.001% of input + 3 digits)/° C
2 kΩ - 200 kΩ range	±(0.001% of input + 1 digit)/° C
2000 kΩ range	±(0.005% of input + 1 digit)/° C
200 MΩ range	±(0.02% of input + 1 digit)/° C

Range	200Ω	2 kΩ	20 kΩ	200 kΩ	2000 kΩ	20 MΩ
Maximum Current Through Unknown	1 mA	1 mA	250 μA	25 μA	2.5 μA	0.25 μA

Overvoltage Protection	300V rms or dc, applied continuously to any range
Maximum Open Circuit Voltage	3.3 volts
Response Time	
200Ω–200 kΩ range	1.0 second maximum to displayed input
2000 kΩ and 20 MΩ range	3.0 seconds maximum to displayed input

Table 1-3. Option Specifications (cont)

Option –008
AC Converter

Ranges	2V, 20V, 200V, 750V
Accuracy	
2V–200V ranges (100% to .1% of range)	
24 Hour, 23°C ±1°C	
100 Hz–10 kHz	±(0.05% of input +10 digits)
45 Hz–100 Hz, 10 kHz–20 kHz	±(0.1% of input +20 digits)
20 kHz–100 kHz	±(1.0% of input +60 digits)
90 days, 18°C–28°C	
100 Hz–10 kHz	±(0.1% of input +10 digits)
45 Hz–100 Hz, 10 kHz–20 kHz	±(0.25% of input +20 digits)
20 kHz–100 kHz	±(1.0% of input +60 digits)
750V range (100% to .1% of range)	
90 days, 18°C–28°C	
(1V to 500V input)	
100 Hz–10 kHz	±(0.15% of input +20 digits)
45 Hz–100Hz, 10 kHz–20 kHz	±(0.25% of input +40 digits)
(500V to 750V input)	
100 Hz–10 kHz	±(0.3% of input +20 digits)
45 Hz–100 Hz, 10 kHz–20 kHz	±(0.5% of input +40 digits)
Temperature Coefficient (0°C–18°C, 28°C–50°C)	±(0.008% of input + 2 digits)/°C, 2V–200V range ±(0.008% of input +4 digits)/°C, 750V range
Input Impedance	2 megohms shunted by less than 100 pF
Response Time to Rated Accuracy within Range	1.5 second maximum to displayed input
Ranging	Full autoranging or manual ranging
Overload Protection	750V dc or rms sinewave, not to exceed 2×10^7 volts hertz product.
Resolution	10 μV on 2V range

Option –009
True RMS Converter

Ranges	2V, 20V, 200V, and 750V
Resolution	10 μV
Accuracy	
24 Hours, 23°C ±1°C, 1%–100% of range	
45 Hz–100 Hz	±(0.25% of input +100 digits)
100 Hz–20 kHz	±(0.15% of input +100 digits)
20 kHz–50 kHz	±(0.20% of input +150 digits)
50 kHz–100 kHz	±(0.80% of input +300 digits)
90 days, 18°C–28°C, 1% – 100% of range	
45 Hz–100 Hz	±(0.40% of input +100 digits)
100 Hz–20 kHz	±(0.20% of input + 100 digits)
20 kHz–50 kHz	±(0.40% of input +150 digits)
50 kHz–100 kHz	±(1.00% of input +300 digits)

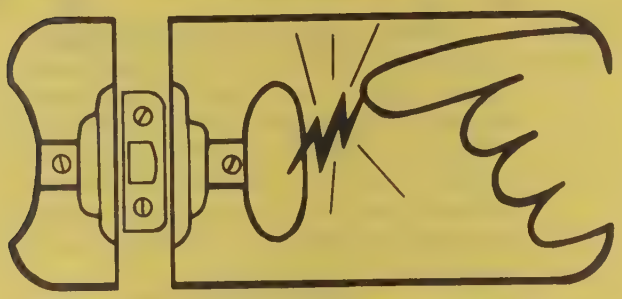
Table 1-3. Option Specifications (cont)

Temperature Coefficient	±(0.02% of input + 5 digits)/°C
Maximum Input	750V rms, 1100V peak or 10^7 volts hertz
AC Input Impedance	1 MΩ in parallel with 100 pF
Crest Factor	3.0
Response Time	1.5 seconds
Overload Protection	500V dc or 750V rms or 1100V peak
Ranging	Full autoranging or manual ranging

static awareness

A Message From

John Fluke Mfg. Co., Inc.



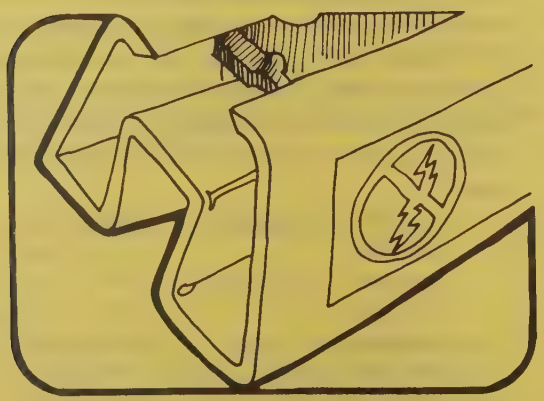
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

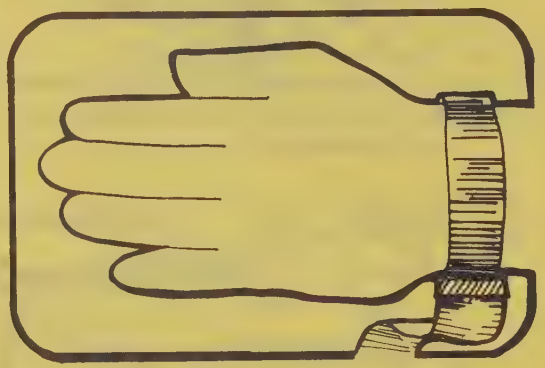
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗"

The following practices should be followed to minimize damage to S.S. devices.

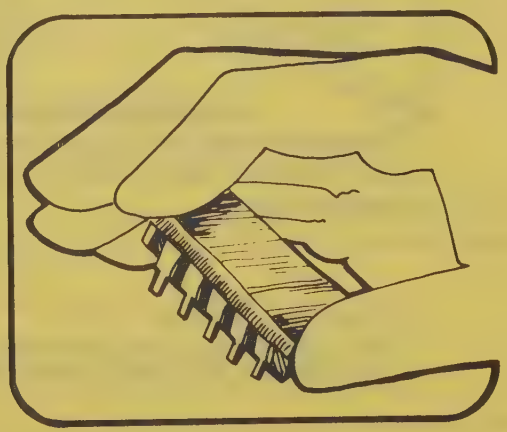
1. MINIMIZE HANDLING



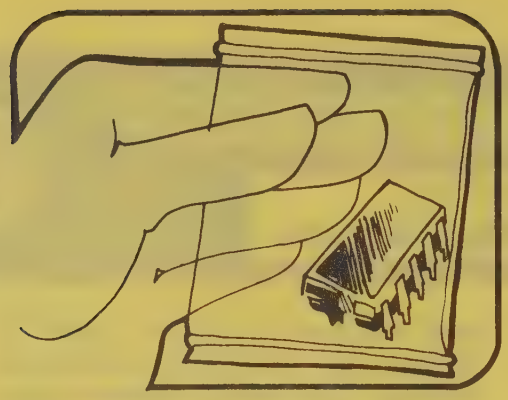
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



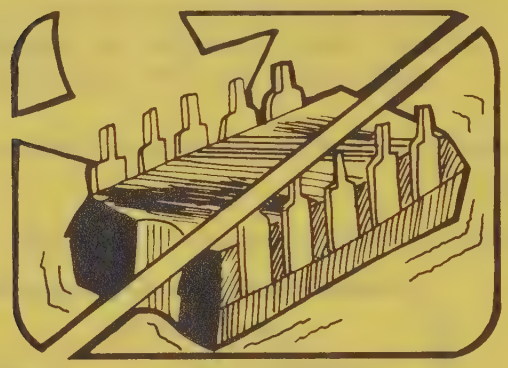
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



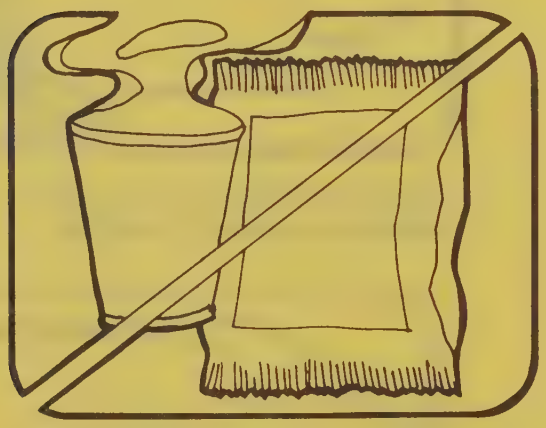
4. HANDLE S.S. DEVICES BY THE BODY



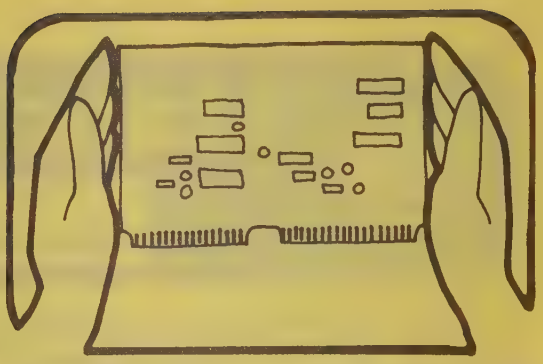
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



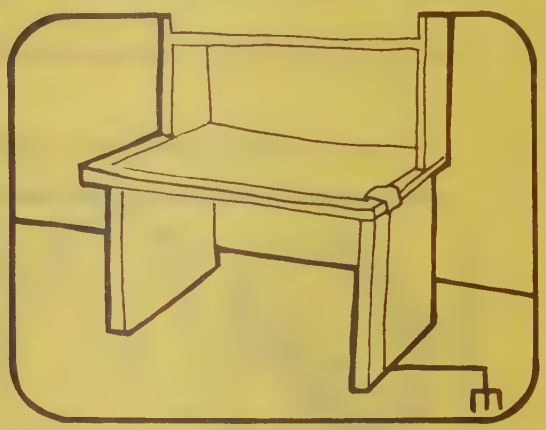
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR USUALLY PROVIDES COMPLETE PROTECTION TO INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Description
453522	6" X 8" Bag
453530	8" X 12" Bag
453548	16" X 24" Bag
454025	12" X 15" Bag
Pink Poly Sheet 30"x60"x60 Mil P/N RC-AS-1200 $20.00	Wrist Strap P/N TL6-60 $7.00

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Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section contains information regarding the installation and operation of the Model 8810A. The contents of this section should be read before operating the digital multimeter. Should any difficulties be encountered during operation, contact your nearest John Fluke Sales Representative or the John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, Washington, 98043. Telephone (206) 774-2211. A list of Sales Representatives is located in Section 7 of this manual.

2-3. SHIPPING INFORMATION

2-4. The Model 8810A was packaged and shipped in a foam-packed cardboard carton. After unpacking the unit, a thorough inspection should be made to reveal any damage that may have occurred in transit.

2-5. If reshipment becomes necessary, the instrument should be repackaged in the original container. If the original container is not available, a new one can be obtained from the John Fluke Mfg. Co., Inc. Please reference the model number (8810A) when requesting a new shipping container.

2-6. INPUT POWER

WARNING

TO AVOID ELECTRICAL SHOCK DISCONNECT THE 8810A FROM LINE POWER BEFORE REMOVING THE UNIT'S CASE. DO NOT APPLY POWER WHILE THE CASE IS REMOVED.

2-7. The 8810A is supplied in one-of-two line power configurations: 115/230V ac, 50 or 60 Hz; or 100V ac, 50 Hz. On the 115/230 volt units, an interior slide switch is provided for selecting the appropriate voltage. Use the following procedure to set this switch.

1. Remove power cord from ac line.

2. Remove two screws on back panel and pull the unit from its case. The line voltage switch is a slide switch located on the rear portion of the Main PCB Assembly.

3. Refer to the rear panel decal and set the line voltage switch to the local line voltage (115 or 230V ac).

2-8. RACK INSTALLATION

2-9. The 8810A can be mounted in a standard 19 inch equipment rack using a Fluke Model M00-200-625 rack mounting accessory kit. Installation instructions are supplied with the kit, and appear in Section 6 of this manual.

2-10. OPERATING FEATURES

2-11. The 8810A front panel controls, indicators, and connectors are shown in Figure 2-1, and described in Table 2-1.

2-12. OPERATING NOTES

2-13. The following paragraphs describe various conditions which should be considered before attempting to operate the 8810A.

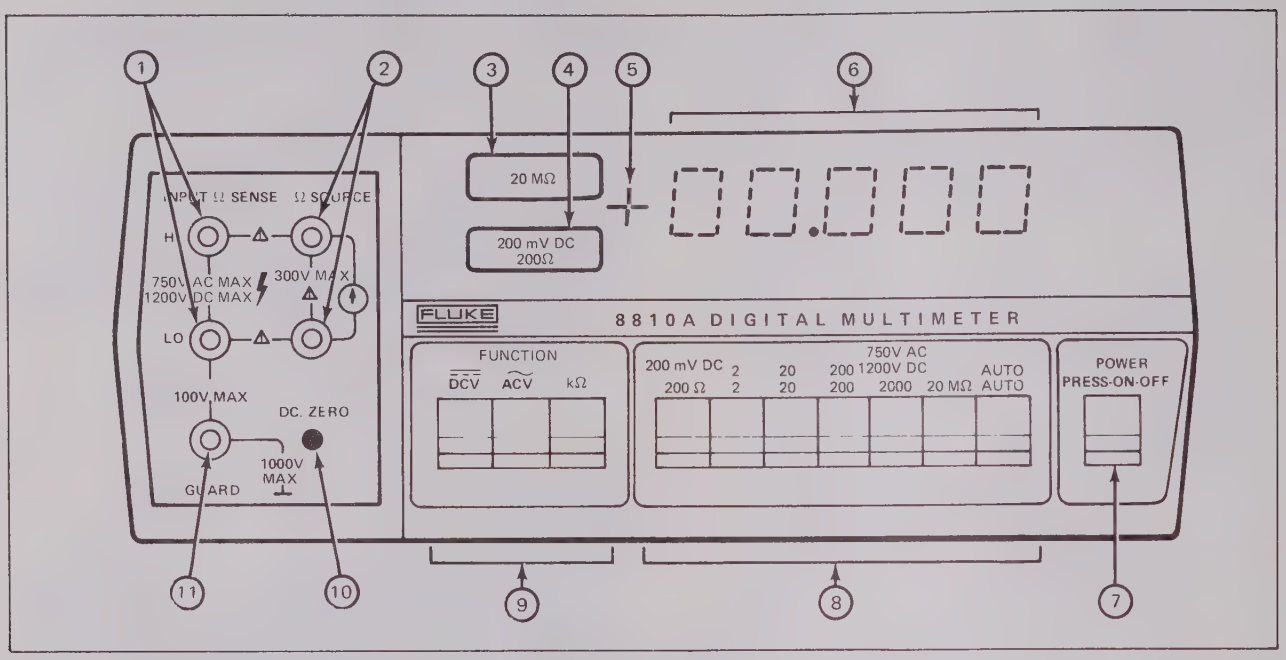


Figure 2-1. Controls, Indicators, and Connectors

Table 2-1. Controls, Indicators, and Connectors

REF. NO.	NAME	FUNCTION
1	INPUT and Ω SENSE Terminals	Provide input connections for ac and dc voltage measurements. Also serve as sense connections for four-terminal resistance (kΩ) measurements.
2	Ω SOURCE Terminals	Provide current source connections to unknown resistor for four-terminal resistance (kΩ) measurements.
3	20 MΩ Annunciator	LED indicator lights when 20 MΩ range is selected.
4	200 mVDC, 200Ω Annunciators	LED indicator lights when 200 mVDC/200Ω range is selected
5	Polarity Indicator	Displays polarity (+ or –) of input signal when making dc voltage measurements.
6	Display	A 4-1/2 digit readout for displaying the value of the measured input signal.
7	POWER Switch	A press-press switch for turning the instrument ON or OFF.
8	RANGE Switch	Interlocked press-on switches that allow range selection for enabled measurement function (DCV, ACV, kΩ). Autorange (AUTO) is included.
9	FUNCTION switches	Interlocked, press-on switches for selecting desired measurement function; DCV, ACV, kΩ. ACV and/or kΩ switch may be mechanically locked to prevent depression if the option is not installed.
10	DC ZERO Adjustment	Screw driver adjustment for zeroing the dc input amplifier. (Short HI–LO INPUT terminals, select 200 mVDC, zero display ±1 digit).
11	GUARD Terminal	Provides connection to internal voltmeter guard.

2-14. Measurement Restrictions

2-15. The basic 8810A is capable of making only dc voltage measurements. However, its measurement capacity can be expanded through the use of field installable options to include resistance and ac voltage measurements. Operating instructions for the added functions are included in this section of the manual. Detailed installation instructions, theory, maintenance, parts list, and schematics are included in Section 6. If the VAC and/or kΩ FUNCTION switch on your instrument cannot be easily depressed, the corresponding option is not installed.

NOTE

The 8810A front panel includes all of the controls, indicators, and connectors required to accommodate the maximum legal combination of options;i.e., 1-AC Converter, 1-Ohms Converter, and/or 1-Digital Output Unit.

2-16. AC Line Connection

2-17. The line power cord is a three-prong, polarized connector which permits the 8810A to be connected to line power. The ground lead on the power cord is connected to chassis ground through the 8810A power supply and should be connected to a high quality earth ground.

2-18. Input Voltage Limits

2-19. The maximum voltage limits that may be applied between adjacent input terminals without damaging the 8810A are given in Table 2-2. These limits may change with selected function.

CAUTION

To avoid instrument damage do not exceed the input voltage limits given in Table 2-2.

2-20. DC Zero

2-21. Before attempting to make precise dc voltage or resistance measurements the 8810A should be energized and allowed to stabilize at the ambient temperature for at least 30 minutes. Then the DC ZERO on the 8810A front panel should be adjusted. Use the following procedure to make this adjustment:

1. Connect a shorting wire between the HI-LO INPUT terminals on the 8810A.
2. Depress both the VDC and the 200 mV switches.
3. Using a small screw driver or adjustment tool, adjust the front panel DC ZERO control for a display reading of 00.000 ± 1 digit.
4. The 8810A is now prepared to measure dc voltages and resistance within its accuracy specifications.

Table 2-2. Maximum Input Voltage for all Functions and Ranges

INPUT TERMINALS	FUNCTION/RANGES			
	VDC		VAC	kΩ
	200 mV to 20V	200V to 1200V	ALL RANGES	ALL RANGES
INPUT HI to INPUT LO	1000V dc	1200V dc	750V ac rms*	300V dc or ac rms
Ω SOURCE HI to Ω SOURCE LO	1200V dc	1200V dc	750V ac rms*	300V dc or ac rms
INPUT HI to Ω SOURCE HI (Shorting link removed)	0.5V	0.5V	0.5V	0.5V
INPUT LO to Ω SOURCE LO (Shorting link removed)	0.5V	0.5V	0.5V	0.5V
INPUT LO to GUARD	100V	100V	100V	100V
GUARD to Earth Ground	1000V	1000V	1000V	1000V

* Option –008 (Avg. AC Option), 750V dc max.
Option –009 (True RMS Option), 500 V dc max.

2-22. Autorange

2-23. The 8810A is capable of autoranging in any of its available measurement functions. Up-ranging occurs when the display digits are ≈ 190000 or larger (disregard decimal point). Down-ranging occurs when the display digits are ≈ 18000 or smaller.

2-24. Guarded Measurements

2-25. The 8810A employs a system of shields and guards that function, when properly connected, to minimize common mode to normal mode signal conversion. The common mode signal, represented by Ecm in Figure 2-2 is the difference in potential between the outer case ground of the multimeter and the ground of the voltage source being measured. This common mode potential can be caused by voltage differences in the ground lines or currents induced in them.

2-26. The input lead and terminal-link configuration illustrated in Figure 2-2A is for unguarded measurements; the most commonly used method. In this configuration it is possible for the common mode voltage (Ecm) to supply common mode current (Icm) via the test lead on the low input terminal, the guard to low-input shorting link, through the inner guard to outer case stray leakage paths, and back to the common mode source. This common mode current flow will cause a normal mode voltage drop across the lead resistance that will add to or subtract from the input voltage being measured. When the lead resitance increases (caused by long input leads or poor connections) or the common mode voltage increases, the resulting normal mode voltage error also increases. This can cause a noticeable error in the multimeter display.

2-27. The guard terminal on the 8810A front panel can be connected in a way that provides a signal path for the common mode current other than through the input leads carrying the normal mode voltage signal. These terminal connections, illustrated in Figure 2-2B, provide for a guarded measurement of the applied input.

2-28. Guarded measurements can be obtained when the following conditions are met:

1. Remove link connecting guard terminal and low input.

2. Connect shield of the input leads to the guard terminal.

3. Connect input end of the shield to same point as the input low lead.

2-29. The above conditions, when met, will effectively extend the inner guard of the instrument out to the end of the input leads. The common mode current will then flow through the shield on the input leads to the guard terminal, across the inner guard to the outer case stray-leakage paths, and back to ground. Therefore, the current no longer flows through the input lead to create the normal mode error voltage.

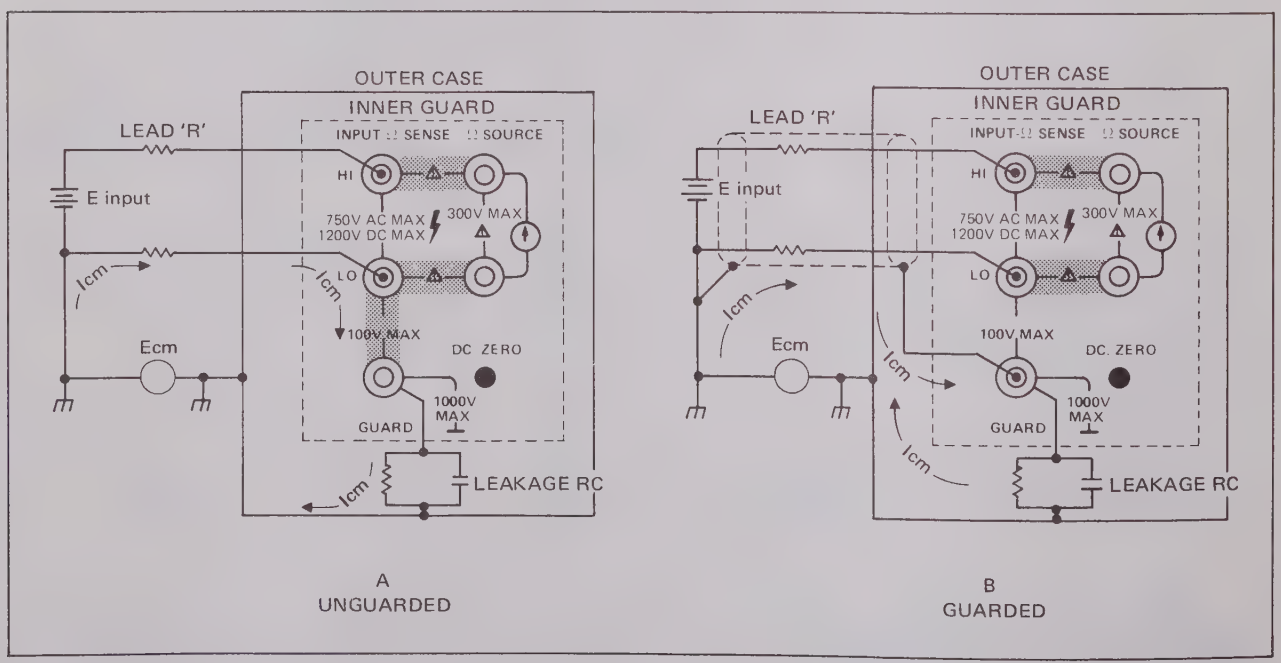


Figure 2-2. Input Terminal Connections

2-30. Resistance Measurements

2-31. The 8810A uses a constant current source and comparison technique for converting unknown resistance values into equivalent voltages. When a kΩ function and ranges is selected, a known constant current source is developed between the HI-LO OHM SOURCE terminals. When an unknown resistance is connected between these terminals an I-R drop is created across the resistor. The current source is calibrated in terms of 1, 10, 100, etc. to ensure that the I-R (voltage) drop is equivalent to the unknown resistance value. A pair of OHMS SENSE terminals (HI and LO) are connected across the resistor and serve as voltage input connections. The sensed voltage is measured in terms of voltage, and displayed as resistance. Obviously, this technique lends itself to either two- or four-terminal measurements. See Figure 2-3 for the recommended input connections.

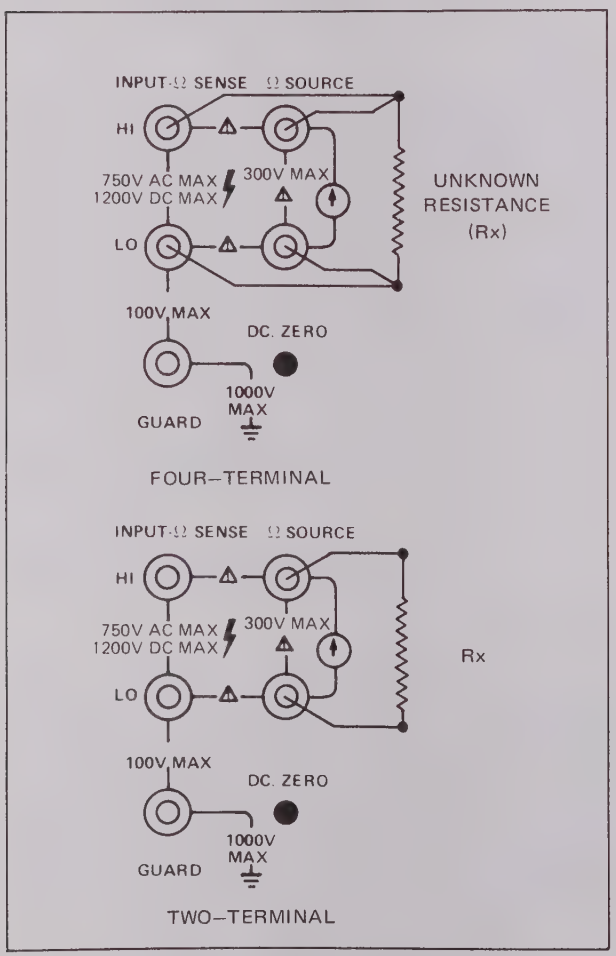


Figure 2-3. Input Terminal Connections for Resistance Measurements

2-32. OPERATION

2-33. Use the following procedure to operate the 8810A:

1. Connect the unit to appropriate line power (See INPUT POWER earlier in this Section).
2. Set the POWER switch to ON (down).
3. Adjust DC ZERO if required.
4. Select desired measurement function (within instrument capabilities) and range by depressing the appropriate FUNCTION and RANGE switches. See Table 2-3.

NOTE

If a range is not manually selected and AUTO is not depressed the highest range for the selected function is enabled.

5. Check and, if necessary, reposition the OHM SENSE and GUARD terminal shorting-links.
6. If test leads are to be used, connect them to the appropriate INPUT terminals.
7. Connect the input signal (or resistance) and read the measured value on the display.

Table 2-3. Measurement Instruction

DESIRED MEASUREMENT	8810A CONFIGURATION		
	FUNCTION	RANGE	INPUT CONNECTIONS
DC Voltage	VDC (Standard)	200 mV, 2, 20, 200, 1200, or AUTO	See Figure 2-2
AC Voltage	VAC (Option –008 or –009)	2, 20, 200, 1200, or AUTO	
RESISTANCE	kΩ (Option –007)	200Ω, 2, 20, 200, 2000 kΩ, 20 MΩ, or AUTO	See Figure 2-3

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. The theory of operation for the 8810A is arranged under two major headings. The first, titled OVERALL FUNCTIONAL DESCRIPTION, discusses the overall operation of the instrument in terms of the functional relationship of the major circuits. The second heading is titled, SIMPLIFIED CIRCUIT ANALYSIS and deals with the internal operation of each major circuit. Block diagrams and simplified circuit diagrams are included to supplement the text. Detailed schematic diagrams are located in Section 8 of this manual.

3-3. OVERALL FUNCTIONAL DESCRIPTION

3-4. Introduction

3-5. The 8810A circuitry can be divided into three major sections. The first of the three sections, termed input signal conditioners, (see Figure 3-1) comprises the VDC Buffer and the optional Ohms Converter (-007) and AC Converter (-008 or -009). The second section is the A/D (analog-to-digital) Converter, and the third is the Control and Display section. The basic operational relationship of these functional areas is shown in Figure 3-1 and will be discussed in following paragraphs.

3-6. Input Signal Conditioners

3-7. The term, input signal conditioner, describes the basic function of the three subsections grouped under it. The VDC Buffer, Ohms Converter, and AC Converter provide the A/D Converter with dc input voltage that is the analog equivalent of the input signal (ac volts, dc volts, or resistance) applied to the instrument. The basic path that each input signal follows as it is conditioned for the A/D Converter is illustrated in Figure 3-1.

3-8. When making a dc voltage measurement the unknown voltage applied to the HI and LO INPUT terminals is directed to the VDC Buffer. The buffer either amplifies the input voltage (200 mV range), passes the entire input voltage as in (2V range), or divides the input voltage by some power of ten (20, 200 and 1200V ranges), so that a conditioned signal of 2 volts dc at the A/D Converter is representative of a full scale input for all ranges.

3-9. When one of the AC Converters (Option -008 or -009) is installed and an ac range is selected, voltage inputs applied to the HI and LO INPUT terminals are directed through closed switch contacts to the AC Converter. These ac input voltages are then converted to dc voltages so that a full scale ac voltage input on any range will produce an AC Converter output to the A/D Converter of 2 volts dc.

3-10. When an Ohms Converter (Option -007) is installed, the 8810A is capable of making two- or four-terminal resistance measurements. The unknown resistance is connected between the HI-LO OHM SOURCE terminals which, in turn, are connected to the respective HI-LO INPUT terminals. The shorting links on the front panel make the connection for two-terminal ohms measurements and the input leads attached to the terminals make the connection during four-terminal ohms measurements.

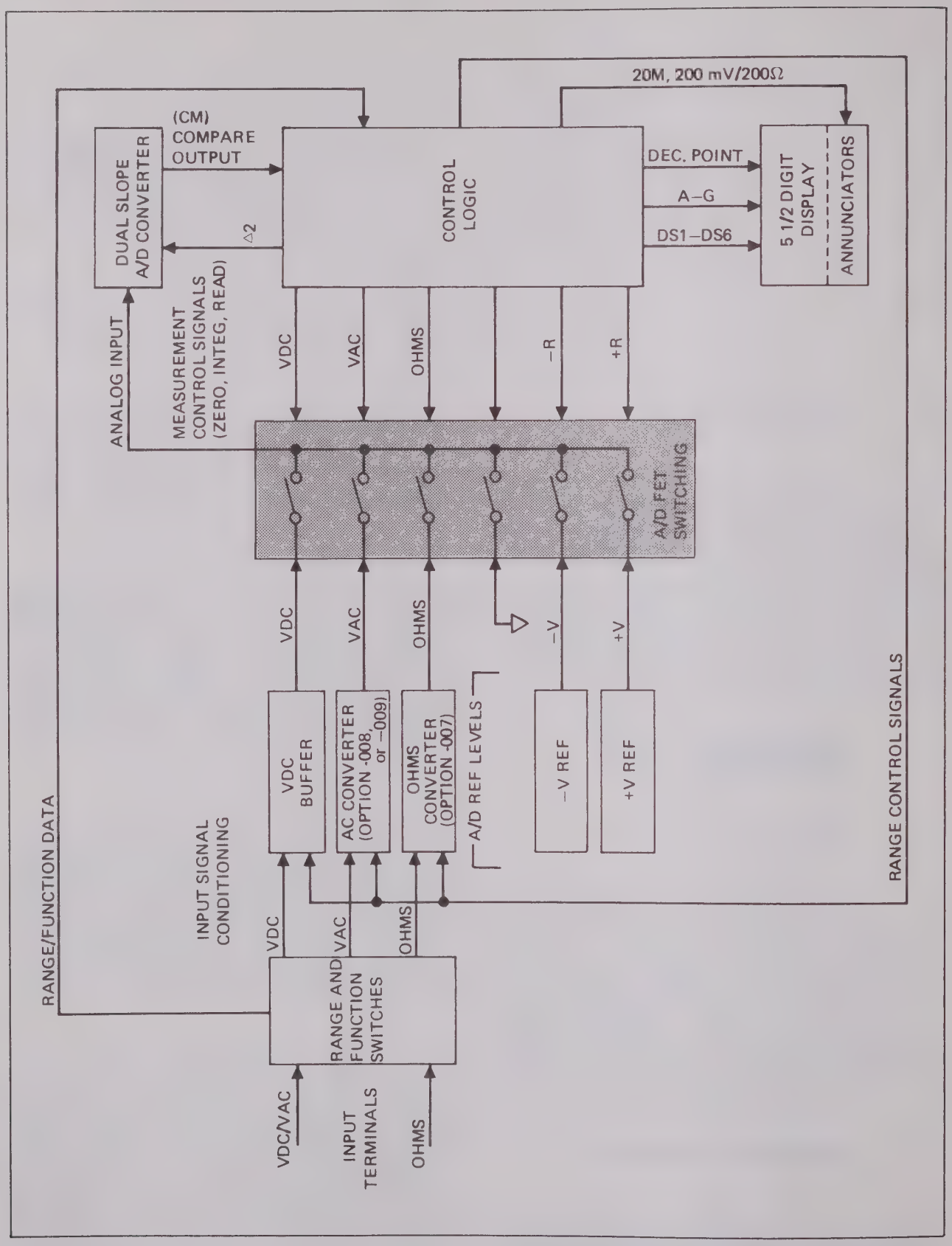


Figure 3-1. Functional Block Diagram

3-12. A/D Converter

3-13. The A/D Converter used in the 8810A employs the dual slope integration technique. It receives its input from the appropriate Input Signal Conditioners and integrates it for 100 ms. Figure 3-2 is an illustration of the output of the a/d integrator. The slope of the integrator output voltage during the integrate period is proportional to the input applied to the instrument. At the end of the integrate period the signal conditioner output is disconnected from the a/d input and a dc reference voltage, of opposite polarity, is connected to the input (start of the read period). The A/D Converter then integrates the reference voltage so that the slope of the read period is always constant. Since the read period slope is held constant, the time required for the a/d integrator output voltage to return to the zero detect point is then proportional to the input signal level.

3-14. The digital representation of the input is obtained by counting the number of cycles of a clock oscillator frequency that occur from the start of the read period to the point where the a/d integrator output voltage returns to the zero detect level. The A/D Converter supplies the Control and Display section with a compare signal at the end of the read period. The compare signal stops the counting of the clock oscillator pulses so that the analog value of the instrument input is now digitally represented by the number of oscillator pulses counted.

3-15. Control and Display

3-16. The Control and Display section provides the control signals that direct the output of the correct input signal conditioner to the A/D Converter during the integrate period. At the end of the integrate time period the Control and Display section connects the appropriate reference supply to the A/D Converter input for the read period. The output of a 1 MHz oscillator is used to maintain the proper timing of the control signals.

3-17. The clock oscillator pulse count, accumulated during the read period, is applied to the LED display to produce the digital readout of the instrument input signal. The range information for the selected range is used to position the decimal point and illuminate the proper display annunciator.

3-18. CIRCUIT DESCRIPTION

3-19. The following paragraphs provide an analysis of the functional areas of the 8810A at a simplified circuit level. The circuits described in these paragraphs correspond to the associated detailed schematic diagrams included at the end of this manual.

3-20. Component reference designators mentioned in the text identify the component on the simplified circuit drawings and on the schematic diagrams. The reference designators for integrated circuits containing two or more gates or functions are presented in text with a numeric suffix. This suffix corresponds to an integrated circuit pin of the particular gate or function. For example, the reference designator U11-6 identifies integrated circuit number 11 and the specific gate or function associated with pin 6.

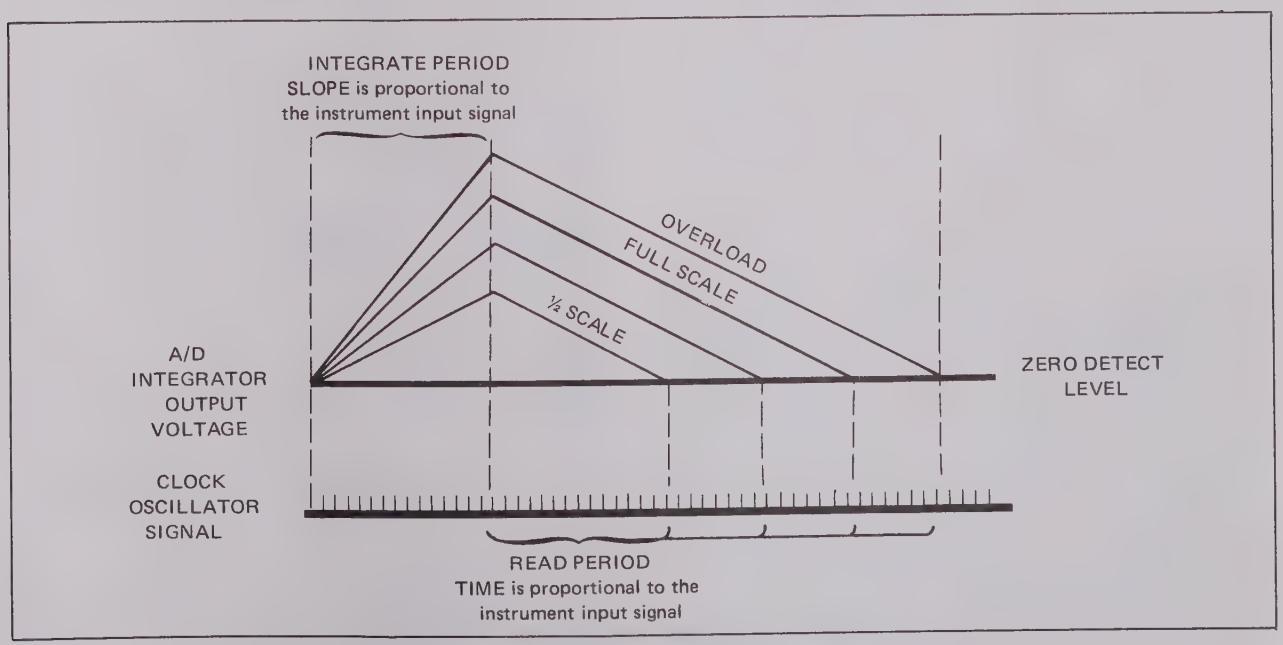


Figure 3-2. A/D Converter Timing Diagram

3-21. Input Signal Conditioners

3-22. OPTIONAL CONVERTERS

3-23. The theory of operation for the optional Ohms Converter and the AC Converters is given in the appropriate subsections of Section 6. For the Ohms Converter See Option -007. The AC Converter and the True RMS Converter are Options -008 and -009, respectively.

3-24. VDC BUFFER

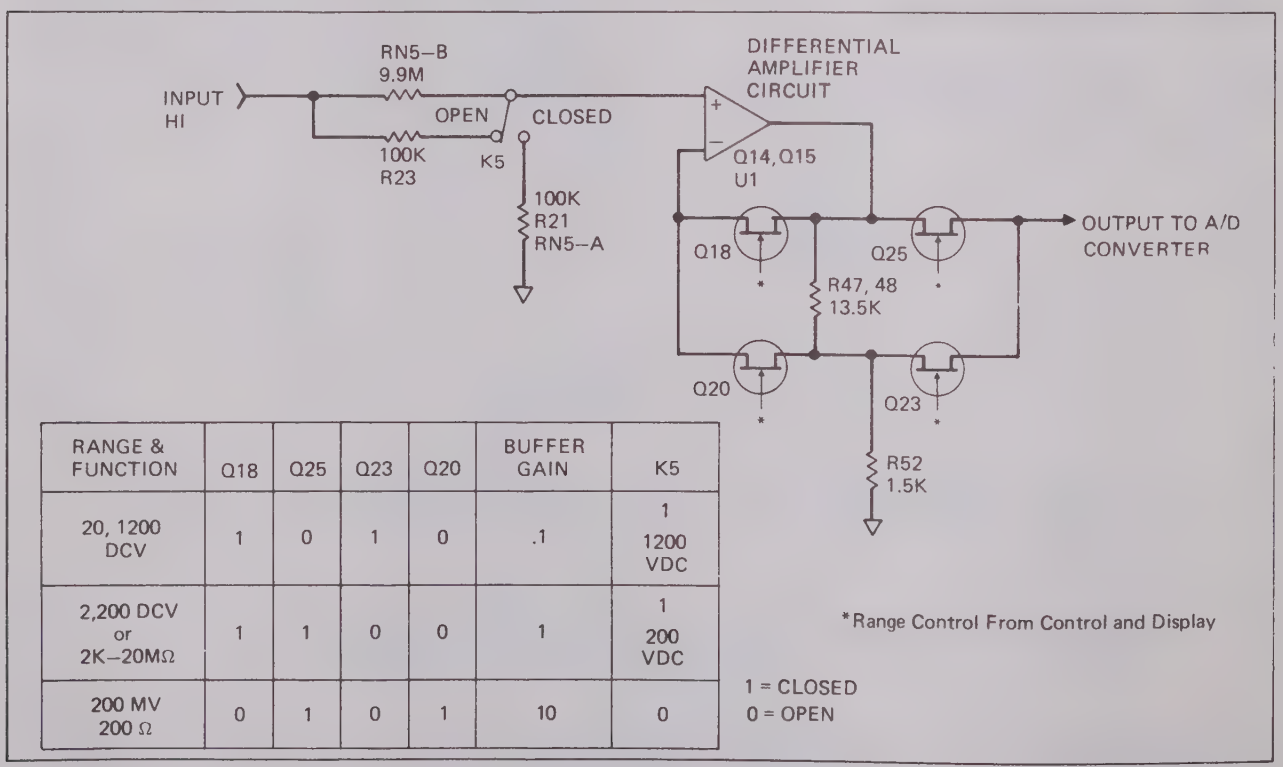
3-25. DC Voltage inputs applied to the instrument are conditioned by the VDC Buffer so that an input within any dc voltage range chosen produces a buffer output of 2 volts dc or less. The simplified buffer circuit shown in Figure 3-3 will be used to illustrate how the overall gain of the buffer is changed with range selection in order to maintain the required output. The optional ohms function also uses the VDC Buffer when determining the value of an unknown resistance. As indicated by the table in Figure 3-3 the buffer gain is 1 (unity) for the 2 KΩ through 20 MΩ ranges and 10 for the 200Ω range.

3-26. When the 200 mV DC or 200Ω range is selected FET switches Q25 and Q20 close. This configuration produces a differential amplifier circuit gain of ten by returning only one-tenth of the amplifier output back to the inverting input. The VDC Buffer output through Q25 to the A/D Converter will be 2 volts for a full scale instrument input of 200 mV or 200Ω.

3-27. A differential amplifier circuit gain of one is obtained when the 2 or 200 VDC range, or 2 kΩ through 20 MΩ range is selected. Range control signals from the Control and Display circuits close switches Q18 and Q25. Direct feedback through Q18 causes the differential amplifier to operate at unity gain. This amplifier circuit configuration produces the required 2 volt full scale input to the A/D Converter. Selecting the 200 volt range in the VDC function, in addition to configuring the differential amplifier circuit for unity gain, closes relay K5 to provide a 100:1 voltage divider (RN5-B, R21, and RN5-A) to reduce a full scale 200 volt instrument input to 2 volts at the amplifier input.

3-29. A/D Converter

3-30. The A/D Converter uses a dual-slope conversion technique. The dc voltage input to the A/D Converter, representing an unknown value of instrument input, is integrated (charges a capacitor) for a controlled length of time (100 ms). The level to which the capacitor is charged is directly proportional to the level of the dc voltage at the input. The capacitor is then discharged at a controlled rate so that the discharge time is proportional to the level of charge on the capacitor. A digital representation of the discharge time is obtained by counting the number of cycles of a reference frequency that occur from the start of discharge to the point where the capacitor charge reaches a selected zero detect level. Figure 3-4 is a basic illustration of the A/D Converter circuit.



RANGE & FUNCTION	Q18	Q25	Q23	Q20	BUFFER GAIN	K5
20, 1200 DCV	1	0	1	0	.1	1 1200 VDC
2,200 DCV or 2K–20MΩ	1	1	0	0	1	1 200 VDC
200 MV 200 Ω	0	1	0	1	10	0

Figure 3-3. VDC Buffer Simplified Circuit Diagram

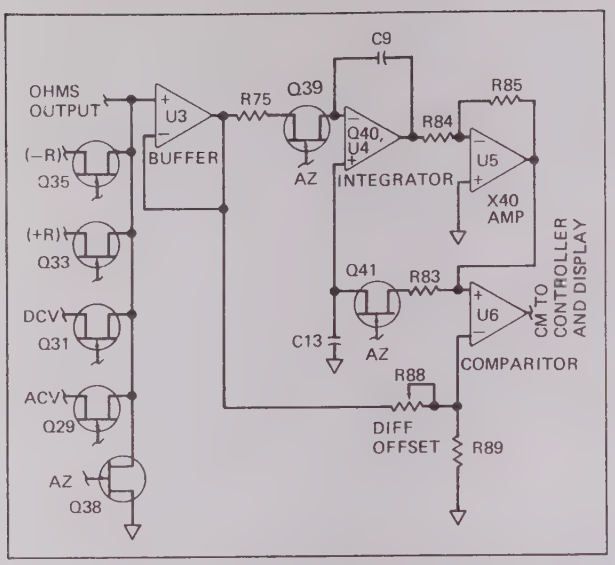


Figure 3-4. A/D Converter Simplified Circuit Diagram

3-31. The input to the A/D Converter is selected from one of the three input signal conditioners. The selected input is applied to U3, a unity gain input buffer, during the integrate time period. The buffer output passes through Q39 to an integrator, the output of which is determined by the level of input applied. The integrator output charges capacitor C9 at a rate determined by the input signal level so that at the end of 100 ms the charge on the capacitor is directly proportional to the input signal applied. At the end of the integrate time period the integrator is isolated from the buffer when control signal $\triangle 2$ opens Q39 for 1 ms. This allows the input to U3 to be changed from the dc voltage representing the unknown input to the appropriate reference input without affecting the charge stored on C9.

3-32. The reference voltage passes through U3 and Q39 to the input of the integrator. Because the polarity of the reference voltage is opposite that of the unknown; the integrator starts to discharge capacitor C9. The rate of discharge is determined by the value of the reference voltage. The charge on C9 is applied to the input of amplifier U5. The amplified output is applied to one input of comparator U6. A dc voltage level, determined by the differential offset adjustment R88, is connected to the other comparator input. When the decreasing charge on C9 reaches the same level as that provided by the differential offset adjust, U6 will produce a compare (CM) output signal to stop the digital count in the Control and Display circuit.

3-33. Control and Display

3-34. The discussion of the Control and Display circuit operation that follows is referenced to the schematic diagrams in Section 8 of this manual. Operation in the VAC FUNCTION will be used as an example of circuit operation.

3-35. Selecting the VAC FUNCTION (switch S2 depressed) provided the AC Control command output at J2-2 and connects the INPUT HI terminal to the AC Converter (Option -008) input. The AC signal is applied to NAND gate in U15 and to switch U20 where it selects the ST2 (strobe 2) signal output for P2-14. With the proper gates enabled by the AC command, the outputs from U11, derived from the 1 MHz oscillator signal, provide timing commands to control the multimeter circuits during the ac volts measurement.

3-36. The measurement cycle starts with the INT (integrate) signal output at U11 pin 40. This signal is inverted by U15-5 to produce the INT command which, when combined with the AC command at U15-9, results in the INT-AC signal used to gate the AC Converter output into the A/D Converter during the integrate time period. As the INT signal U11-40 goes high, indicating the end of the 100 ms integrate time period, the $\triangle 2$ signal at U11-3 goes high for 1 ms while the input to the A/D Converter is switched from the unknown to the reference voltage. The reference supply signal comes from U11-39, DE (–R) (read period, negative reference). This signal is inverted by U13-14 and applied to U14-3. Since U14-5 is held high, unless the KΩ function is called, the DE (–R) •Ω command will gate the negative 1 volt reference to the A/D Converter input for the read time period.

3-37. At the end of the $\triangle 2$ signal, decade counters within U11 start to count the cycles of the 1 MHz oscillator input at U11-6. The count accumulation continues unitl a compare (CM) signal from the A/D Converter is received at U11-5. The total in each decade counter is converted to a bcd format, identified as signals W, X, Y, and Z with corresponding bit weights of 8, 4, 2, and 1. The digit information is strobed out to the display from pins 34, 33, 32, and 31 of U11, one significant digit at a time.

3-38. Eight strobe signals numbered ST0 through ST7, are created within U11 to properly time the transfer of data from U11 to the display. Six strobe signals (ST0, ST1, ST2, ST3, ST4, and ST6) are used to transfer digit information and the remaining two (ST5 and ST7) transfer range, polarity and overlaod data. The most significant digit of the display is the first to be strobed out of U11. Strobe signal ST0 from U11-15 passes through switch U20-13 to U20-14 (VDC function causes the switch to shift to pin 12) to the display strobe driver Q44 and Q45. The DS1 (display digit 1) output signal on P1-3 is applied to pins 1 and 14 of the most significant digit LED (DS1), enabling only that LED to display the incoming digit information. The same ST0 strobe signal is used within U11 to cause the bcd information for the most significant digit to be applied, via U11 pins 34, 33, 32, and 31, to the seven-segment decoder U16. The bcd code input causes the decoder to illuminate segments of the LED to display the corresponding number. Each LED is individually strobed to display the corresponding significant digit output from U11.

Section 4
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section of the manual contains information concerning maintenance and servicing of the Model 8810A Digital Multimeter. A calibration interval of 90 days is recommended to insure instrument operation within the 90 day specifications. Test equipment recommended for performance test, calibration adjustments and troubleshooting is listed in Table 4-1. If the recommended equipment is not available, equipment of equivalent specifications may be used.

4-3. SERVICE INFORMATION

4-4. Each instrument manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of 1-year upon delivery to the original purchaser. The WARRANTY is printed on the back of the title page located at the front of the manual.

4-5. Factory authorized calibration and service for each Fluke produce is available at various world wide locations. A complete list of these service centers is included with the WARRANTY. Shipping information is given in Section 2 of this manual. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

4-6. GENERAL MAINTENANCE

4-7. Access/Disassembly

4-8. The following procedure is used to gain access to the interior of the 8810A:

1. Remove the line-power cord from the unit.
2. Remove the molded plastic outer cover; two screws at the rear of the unit hold it in place. This provides access to the calibration adjustments.
3. Remove the top and bottom guard covers by sliding the covers one-half the distance to the rear of the unit, and then lift them free. This allows access to the components on the various printed circuit boards.

CAUTION

The area on the Display PCB Assembly where the input terminals extend through, must not be contaminated in any way. The inter terminal leakage caused by contamination will result in calibration errors.

4. Remove the optional AC Converter PCB (-008, -009) or Ohms Converter PCB (-007) by disconnecting the associated wires and pulling the pcb straight away from the Main PCB.

Table 4-1. Required Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
AC Calibrator	Voltage Range: 0 to 1000V ac Frequency Range: 50 Hz to 100 kHz Voltage Accuracy: 50 Hz to 20 kHz 0.03% 20 kHz to 100 kHz 0.05%	John Fluke Model 5200A and 5205A
DC Calibrator	Voltage Range: 0 to 1000V dc Accuracy: 0.003%	John Fluke Model 332B
Voltage Divider	Ratio Range: 0 to 1.0 Absolute Linearity: ±1 ppm of input at dial setting	John Fluke Model 720A
Resistor Decade	Resistance Accuracy: 0.005%	ESI 1063B
Oscilloscope	General Purpose with 10MΩ Probe	Tektronics Model 453
Digital Multimeter	Voltage Accuracy: 0.1% Input Impedance: 10MΩ	*John Fluke Model 8000A

* If the selectable offset voltage correction resistor procedures are performed a DVM with a 1μV resolution is required; recommend a John Fluke 8400A or 8800A.

NOTE

When reinstalling the AC/RMS Converter and Ohms Converter PCB's, insure that all connector pins are properly aligned before seating the board.

4-9. Cleaning

4-10. Clean the instrument periodically to remove dust, grease and other contamination. Use the following procedure:

1. Clean the front panel and exterior surfaces with anhydrous ethyl alcohol or a soft cloth dampened with a mild solution of detergent and water.

2. If cleaning of the interior is necessary, use clean, dry air at low pressure (< 20 psi). If contaminants remain, individual pcbs can be cleaned using warm water. However, any items likely to be affected by the water (relays, meters, etc.) shoud be removed first. To remove excess water use clean, dry air followed by oven drying at ⩽ 50°C. If any solvent is used, such as freon, it should be kept clear of any switches or potentiomenters since it removes lubrication and shortens their life span dramatically.

4-11. Fuse Replacement

WARNING!

AC LINE VOLTAGE IS PRESENT AT THE FUSE HOLDER WHENEVER THE POWER CORD IS CONNECTED. REMOVE THE POWER CORD BEFORE SERVICING THE FUSE.

4-12. The power fuse (F1) is located in the right rear corner of the instrument, and can be reached by performing the Access/Disassembly procedure. If replacement is necessary, use an AGC ¼ ampere fuse for either 115 or 230V ac line power.

4-13. LED Replacement

4-14. The following procedure is used to replace the Display or indicator LEDs:

1. Perform steps 1 through 3 of the Access/Disassembly procedure.

2. Disconnect the two flat cables at the Main PCB connectors.

3. Disconnect the wires from the connector posts on the Display PCB.

4. Remove the four side screws connecting the Front Panel to the side chassis. Lift the Front Panel away from the main portion of the instrument.

5. Remove the binding-post nuts and the two phillips screws, and lift the Display PCB away from the Front Panel.

6. Unsolder and replace the defective LED.

7. To reassemble logically reverse this procedure. Make sure that the switch lever fingers mesh between the crossbar and the lower retaining ring on each switch plunger.

4-15. PERFORMANCE TEST

4-16. The performance test is designed to compare the 8810A performance with the accuracy specifications given in Section 1 of this manual. It is recommended as an acceptance test when the unit is first received and later as a 90 day calibration procedure. If the instrument fails any part of the test, calibration adjustment and/or repair is indicated.

4-17. Initial Procedure

4-18. Each of the procedures that comprise the performance test assume that the following initial conditions exist:

1. The unit has stabilized and will be tested at an ambient temperature of 23 ±5°C, and a relative humidity of less than 70%.

2. The unit has been connected to line power and the POWER switch is set to ON.

3. Set dc calibrator output to 0V dc and connect its output to the input of the resistive divider.

NOTE

The divider should be set to X1 for all specified voltages ≥ 2.0V dc. Maximum calibrator accuracy is attained by using the divider for lower voltage requirements.

4-19. DC Volts Test

4-20. Use the following procedure to test the operation and accuracy of the dc voltage function and its ranges:

1. Connect a shorting wire between the HI-LO INPUT terminals on the 8810A.

2. Depress both the VDC and the 200 mV switches on the 8810A.

3. Using a small screw driver or adjustment tool, adjust the front panel DC ZERO control for a display reading of 00.000 ±1 digit.

4. Select the 2 VDC range on the 8810A. The display should read within the first display limits listed in Table 4-2 (.0000 ±1 digit).

5. Remove the shorting wire from the 8810A and connect the divider output to the HI-LO INPUT terminals.

6. Refer to Table 4-2 and sequentially set the dc calibrator/divider output to each of the input voltages listed. At each voltage, select appropriate RANGE switch setting. Then compare the display reading with the appropriate limits and annunciator indications listed in the table.

Table 4-2. DC Voltage Test

RANGE	INPUT	DISPLAY LIMITS			ANNUNCIATOR
2 VDC	Shorted	−.00001	–	+.00001	
	+1.00000	+.99987	–	+1.00013	
	−1.00000	−1.00013	–	−.99987	
	+1.90000	+1.89978	–	+1.90022	
	−1.90000	−1.90022	–	−1.89978	
20 VDC	+19.0000	+18.9978	–	+19.0022	
	−19.0000	−19.0022	–	−18.9978	
200 VDC	+190.000	+189.978	–	+190.022	
	−190.000	−190.022	–	−189.978	
1200 VDC	+1000.00	+999.87	–	+1000.13	
	−1000.00	−1000.13	–	−999.87	
200 mV	+.10000	+99.980	–	+100.020	200m VDC
	−.10000	−100.020	–	−99.980	200m VDC
AUTO	+.10000	+99.980	–	+100.020	200m VDC
	+1.00000	+.99987	–	+1.00013	
	+10.0000	+9.9987	–	+10.0013	
	+100.000	+99.987	–	+100.013	
	+1000.00	+999.87	–	+1000.13	

4-21. Autoranging Test

4-22. The following procedure verifies the accuracy of the range change voltage points for the autorange circuit:

1. Connect the divider output to the 8810A HI-LO INPUT terminals.

2. Depress the VDC FUNCTION switch.

3. Depress the AUTO RANGE switch.

4. Adjust the dc calibrator/divider for a +200 mV dc output. The display should read +.19995 to +.20005.

5. Decrease the dc calibrator/divider output to 183 mV. The 8810A display should read +.18295 to +.18305.

6. Decrease the divider output in 1 mV steps until the 8810A autoranges. The meter should revert to the 200 mV range and the display should read between +177.500 and +182.500 mV.

7. Increase the divider output in 1 mV steps until the 8810A autoranges. The meter should step to the 2 VDC range and the display should read slightly more than +.19000.

4-23. CALIBRATION ADJUSTMENTS

4-24. Calibration adjustments are required after repair or whenever the 8810A fails the Performance Test. Equipment required is listed in Table 4-1. Perform the procedure at an ambient temperature of 23 +1°C and a relative humidity of 80% or less. Complete all adjustment procedures in the order given. See Figure 4-1 for adjustment locations.

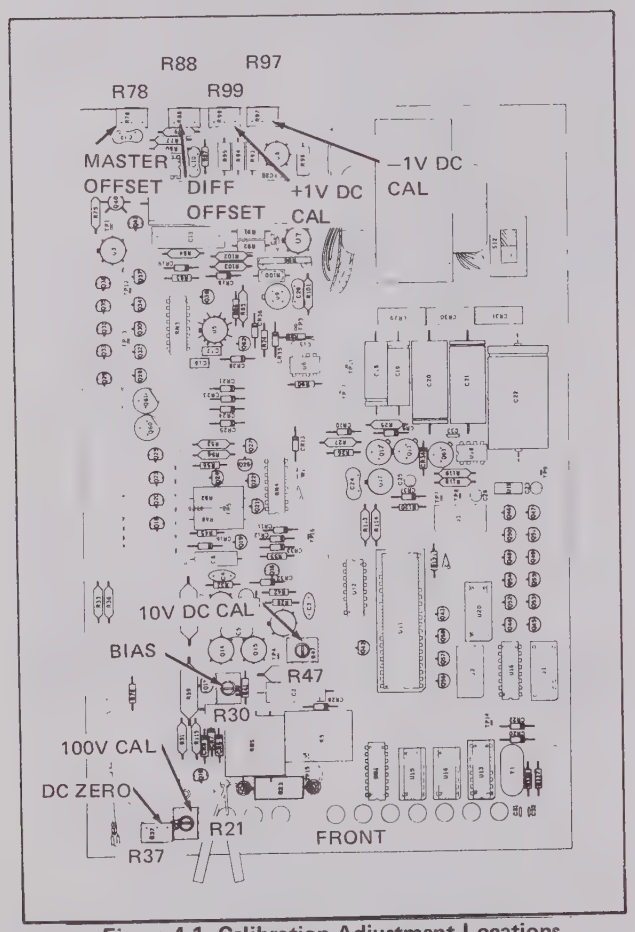


Figure 4-1. Calibration Adjustment Locations

4-25. Initial Procedure

4-26. Each of the following calibration adjustment procedures assume that the following initial conditions have been met. Perform the following steps:

1. Remove the 8810A from its plastic outer case.
2. Do not remove the top inner guard cover.
3. Connect the 8810A to line power and set the POWER switch to ON.
4. Allow the 8810A to stabilize at ambient temperature for at least one-half of an hour.
5. Set the dc calibrator output to 0V dc and connect its output to the input of the resistive divider.

NOTE

The divider should be set to X1 for all specified voltages ≥ 2.0V dc. Maximum calibrator accuracy is attained by using the divider for lower voltage requirements.

4-27. DC Zero

4-28. Adjust the front panel DC ZERO pot (R37) as follows:

1. Connect a shorting wire between the HI-LO INPUT terminals.
2. Select the VDC function and the 200 mV range.
3. Adjust the DC ZERO pot for a display of 00.000 ±1 digit.
4. Remove the short from the INPUT terminals.

4-29. DC Bias

4-30. Use the following procedure to adjust the DC Bias Resistor (R30):

1. Connect a 1 megohm resistor and a 0.1 μF capacitor in parallel between the HI-LO INPUT terminals.
2. Select the VDC function and the 200 mV range.
3. Adjust the Bias resistor, R30, for a display of 00.000 ±3 digits.
4. Repeat the DC ZERO procedure and this procedure until no further adjustment of DC ZERO is required.
5. Remove the resistor and capacitor from the INPUT terminals.

4-31. VDC Function and Ranges

4-32. The following procedure is used to calibrate the VDC Function and Ranges:

1. Select the VDC function and the 2V range.
2. Connect the dc calibrator/divider output to the HI-LO INPUT terminals on the 8810A.

3. Adjust the dc calibrator divider for a +1.0 mV input to the 8810A.

4. Alternately reverse the INPUT terminal connections (+1.0 mV and -1.0 mV) and adjust the MASTER OFFSET resistor (R78) for the same absolute number with either polarity as an input.

5. Apply +1 mV to the INPUT terminals and adjust DIFF OFFSET resistor (R88) for exactly +.00100 on the 8810A display. Occational flashing of +.00101 or +.00099 is acceptable.

6. Disconnect the dc calibrator/divider output from the 8810A and connect a short across the HI-LO INPUT terminals.

7. Select the 200 mV range and, if necessary, zero the display by adjusting the front panel DC ZERO pot.

8. Remove the short from the INPUT terminals and repeat steps 1 through 5 of this procedure. Adjust as required.

9. Select the 2V range and connect the dc calibrator/divider to the HI-LO INPUT terminals.

10. Adjust the dc calibrator/divider for a +1.00000V input to the 8810A.

11. Adjust the +1V CAL resistor (R99) for a display of +1.00000 ±1 digit.

12. Increase the input voltage to +1.90000V. The display must read 1.90000 ±3 digits.

13. Reverse the 8810A INPUT terminal connections and adjust the dc calibrator/divider for a -1.00000V input.

14. Adjust the -1V CAL resistor (R97) for a display of -1.00000 ±1 digit.

15. Increase the input voltage to -1.90000V. The display must read -1.90000 ±3 digits.

16. Refer to Table 4-3 and apply each of the positive and negative input levels shown. The display should read within ±1 digit of the applied voltage.

17. Select the 20V range.

18. Apply a +10.0000V input to the 8810A and adjust the 10 VDC resistor (R47) for a display of +10.0000 ±1 digit.

19. Decrease the 8810A input to +100.000 mV.

20. Select the 200 mV range. The display should read +100.000 ±4 digits.

21. Reverse the 8810A INPUT connections. The display should read -100.000 mV ±4 digits.

22. Select the 200V range.

23. Adjust the dc calibrator/divider for a +100.000V input to the 8810A.

24. Adjust the 100 VDC resistor (R21) for an 8810A display of 100.000 ±1 digit.

25. Select the 1200V range and increase the input signal to +1000.00V. The display should read +1000.00 ±3 digits.

26. Decrease the calibrator output to a safe level and disconnect it from the 8810A INPUT terminals.

Table 4-3. DC Linearity Check

INPUT	DISPLAY
± .00100 V	± .00100 ± 1 digit
± .01000 V	± .01000 ± 1 digit
± .10000 V	± .10000 ± 1 digit
± .20000 V	± .20000 ± 1 digit
± .30000 V	± .30000 ± 1 digit
± .40000 V	± .40000 ± 1 digit
± .50000 V	± .50000 ± 1 digit
± .60000 V	± .60000 ± 1 digit
± .70000 V	± .70000 ± 1 digit
± .80000 V	± .80000 ± 1 digit
± .90000 V	± .90000 ± 1 digit
±1.00000 V	±1.00000 ± 1 digit

4-33. Options

4-34. Calibration adjustments for each of the available options are included in Section 6 of this manual. If your instrument contains one or more of these options they may be calibrated in any sequence following the previous Calibration Adjustments procedure.

4-35. TROUBLESHOOTING

CAUTION

Static discharge can damage MOS components contained in the 8810A. To prevent this possibility use the following precautions when troubleshooting and/or repairing the unit.

1. Never remove, install or otherwise connect or disconnect pcb's and/or components without first setting the POWER switch to OFF.

2. Perform all repairs at a static free work station.

3. Do not handle IC's or pcb's by their connectors.

4. Use static ground straps to discharge repair personnel.

5. Use conductive foam to store replacement or removed IC's.

6. Remove all plastic, vinyl and styrafoam products from the work area.

7. Use a grounded soldering iron.

4-36. The information given in the following paragraphs is provided to assist in isolating malfunctions in the 8810A. Before troubleshooting the instrument, however, it should be verified that the cause for the malfunction is actually in the instrument and not caused by faulty external equipment or improper control settings. For this reason, the performance test (given earlier in this section) is suggested as the first step in troubleshooting. The performance test may also help to localize the trouble to a particular section of the instrument.

4-37. The following reminders of basic fault isolation will help determine if the cause if the result of an internal malfunction or faulty external connection.

1. Carefully check the 8810A control settings: some false indications may be caused by an incorrect or overlooked control setting.

2. Check associated equipment: insure the associated equipment control settings and connections are correct.

3. Carefully inspect the interior of the instrument: check for physically damaged parts, loose or broken wires and improperly seated plug-in assemblies.

4-38. When it is determined, by the above checks, that the malfunction is within the 8810A the following procedure can be used to isolate the problem area. The recommended test equipment for troubleshooting is listed in Table 4-1.

4-39. Power Supply Check

4-40. Incorrect output voltages from any of the power supplies may cause the multimeter to exhibit various improper indications. The power supply voltages should be checked in the event of any instrument malfunction. Use the following procedure to check the voltage output of each power supply. Figure 4-2 illustrates where the connections are to be made for checking each supply.

1. Connect the test equipment voltmeter common lead to INPUT LO terminal.

2. Connect the test equipment voltmeter high input lead to TP7 (+18 volt supply). The supply output should be +18.02 ±0.10 volts.

3. Connect the test equipment voltmeter high input lead to TP8 (–18 volt supply). The supply output should be –18.02 ±0.10 volts.

4. Connect the test equipment voltmeter high input lead to the positive end of C18 (+35 volt supply). The supply output should be +35.0 ±5.0 volts (at 115V ac line voltage).

5. Connect the test equipment voltmeter high input lead to the negative end of C19 (–35 volt supply). The supply output should be –35.0 ±5.0 volts (at 115V ac line voltage).

6. Connect the test equipment voltmeter high input lead to TP9 and low input to TP8. The voltmeter should indicate +5.0 ±0.2 volts.

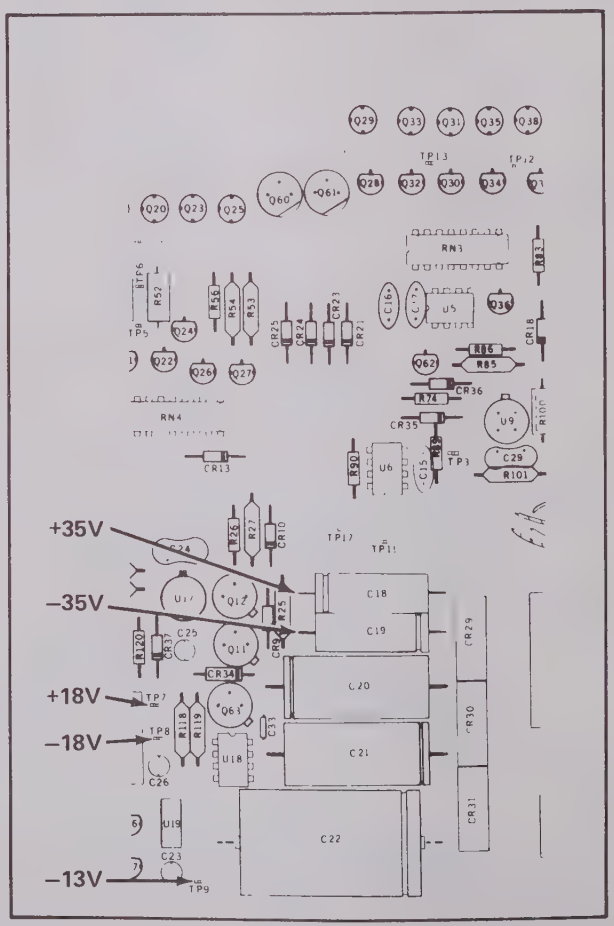


Figure 4-2. Power Supply Voltage Test Points

4-41. The +18 volt, +7 volt supplies all share a common reference provided by U9. The –18 volt supply receives operating dc voltage from the +18 volt supply. Problems occurring in one supply may cause improper operation of the others. The following procedure provides for open loop operation of the supplies to aid in localizing the defective supply.

1. Unsolder and lift one end of R120.

2. Short pins 3 and 4 of U17 together. This will utilize the internal reference of U17 for control.

3. Check the voltage outputs of the +18 volt supply, TP7 (this supply may be out of prescribed tolerance limits because of the change to the U17 internal reference, +7 volt supply TP11, –7 volt supply TP11, –7 volt supply TP10 and –18 volt supply TP8).

4. Repair the faulty supply.

5. When all supplies are operating properly, remove the short from U17 pins 3 and 4, reconnect R120 an check the supplies for proper operation.

4-42. Fault Area Isolation

4-43. A malfunction in the 8810A may be isolated to a particular section of circuitry by observing the displayed symptoms during the multimeter operation in each function. The results of the Performance Tests will indicate the multimeter functions affected by the malfunction. The problem areas, indicated by the various improper functional displays, are presented in Table 4-4. Four vertical columns, describing the 8810A operational status in each of the three functions as being either proper or improper, indicate the functional area of the multimeter where the problem is most likely to be found. Close observation of the symptoms displayed on the front panel coupled with a knowledge of the theory of operation (Section 3) may further define the problem area.

4-44. Troubleshooting information for each functional area is presented in the following paragraphs. Proceed to the paragraphs that provide the troubleshooting information for the problem area indicated by the fault area isolation procedure. Keep in mind, however, that a malfunction within one functional area may affect the operation of another.

4-45. AC CONVERTER (OPTION -008, -009)

4-46. Generally a failure in the AC Converter will do one of two things: create a dc voltage output without an ac input signal applied or, not produce the proper dc voltage for the A/D Converter when an ac input signal is applied. A dc output generated by the AC Converter will cause the multimeter display to indicate some value of ac voltage, in the two highest ranges, when a short is placed across the input terminals. When an ac signal is applied to the input, and the display remains at zero, the ac converter is not producing the proper dc output voltage to the A/D Converter.

4-47. VDC BUFFER

4-48. The 8810A front panel display will generally indicate a buffer malfunction in one of three ways. First, the display presents an overrange indication (flashing +188888) for all inputs applied to the instrument. Second, the display will not indicate any applied dc input; producing a displayed readout of 000000 plus two or three digits of noise. Third, the display indicates that some value of offset is being added to all inputs. This offset malfunction will usually produce a display indication even without an input applied to the instrument.

Table 4-4. Problem Area Isolation

8810A FUNCTION	8810A OPERATION IN EACH FUNCTION IS –			
DC V	PROPER	IMPROPER	PROPER	IMPROPER
AC V	IMPROPER	PROPER	PROPER	IMPROPER
OHMS	PROPER	IMPROPER	IMPROPER	IMPROPER
PROBLEM AREA INDICATED	AC CONVERTER	VDC BUFFER	OHM CONVERTER	A/D CONVERTER OR CONTROL AND DISPLAY

4-49. Malfunctions within the VDC Buffer may cause the display to be improper on one or two ranges and correct on the others. The overall gain of the buffer is changed for each range. Table 4-5 lists the five dc voltage ranges and the components that control the circuit configuration to produce the proper gain for each range. Noting the range or ranges affected by the malfunction may point to the gain control component or associated circuitry causing the problem.

4-50. OHMS CONVERTER (OPTION -007)

4-51. Use the following procedure when troubleshooting malfunctions within the Ohms Converter. Remove the 8810A from the outer case. Remove the top inner guard cover. Select the kΩ function and the 200Ω range.

1. Connect a 1 OHM resistor across the Ω SOURCE terminals.

2. Measure the voltage drop across the 1 OHM resistor. The ohms converter should supply enough current to develop 1 ±0.3 mV across the resistor.

3. If the voltage across the resistor is less than 0.8 mV, short across Q2 emitter to collector. The voltage across the resistor should now be 0.8 mV or greater. If it is; Q21, Q1, Q2 or CR12 is causing the malfunction.

4. Overrange indications in the ohms function can be caused by a failure of Q6 to turn-on and apply the reference voltage to the A/D Converter. Q6 may be open or the gate signal may not be present during the read period.

5. Select the 20 kΩ range.

6. Measure the voltage drop across R29. The inverter should supply enough current to develop –6.7V ±0.2V across R29.

7. If the voltage is less than –6.5V the problem is contained within the inverter, Q24, A25, or the clock input, which should be 1 MHz.

8. If the inverter checks out, test the voltage dropped across R26. It should be –2.5V ±0.5. If the voltage does not meet this specification, then the trouble is contained within the regulator, (Q22, Q23) and their associated components, or Q8, Q6, and Q4.

4-52. A/D CONVERTER OR CONTROL AND DISPLAY

4-53. If the display symptoms observed during the fault area isolation procedure indicate that the problem is either in the A/D Converter or Control and Display, the following procedure should aid in locating the faulty component. Because the timing of the control signals used to process the input signal through the A/D Converter and display circuits is critical to the proper operation of these sections, an oscilloscope should be used to make the voltage and signal checks.

4-54. The A/D Converter operation can be checked using the following procedure.

1. Select the VDC function and 2 volt range.

2. Apply ±1 volt dc to the 8810A input terminals.

3. Measure the input to the A/D Converter at TP13. The voltage, TP13 high to the INPUT LO terminal, should be +1 volt dc.

Table 4-5. VDC Buffer Gain Control

RANGE	Q18	Q25	Q23	Q20	K5	TOTAL BUFFER GAIN
200 mV	open	closed	open	closed	open	10
2 V	closed	closed	open	open	open	1
20 V	closed	open	closed	open	open	.1
200 V	closed	closed	open	open	closed	.01
1200V	closed	open	closed	open	closed	.001
	Q18, closes to provide a gain of one across Q14, Q15 & U1	Q25, closes to present full buffer output to A/D	Q23, closes to divide the buffer output by 10	Q20, closes to increase the gain of Q14, Q15 & U1 by 10	K5, closes to divide the buffer input by 100	

NOTE

Connect the oscilloscope external sync input via a X10 probe to TP16 during the remainder of this procedure. The scope control settings are provided on the wave shape illustration.

4. Connect the scope between TP1 (high) and the LO INPUT terminal. The scope should display the waveform shown in Figure 4-3.

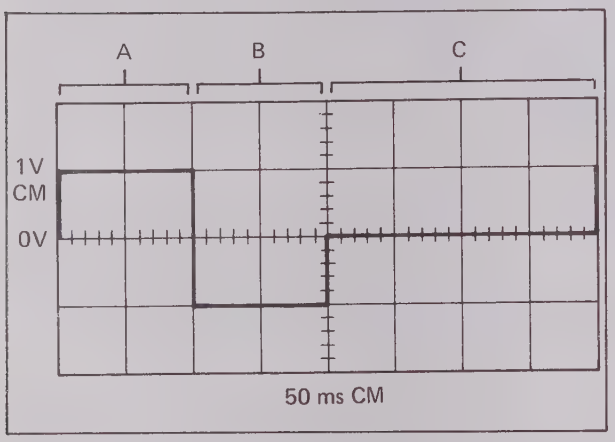


Figure 4-3. TP1 Waveform

4-55. The waveform at TP1 can indicate several possible problems in the circuitry. The 100 ms period designated A is the integrate period during which the unknown 8810A input (in this case, 1 volt) is applied to the integrator (Q40 and U4). The 100 ms time designated B is the read period when the reference (in this case, –1 volt) is applied to the integrator. The length of period B (read) will change with a change in voltage level applied to the 8810A input within the range selected. The section designated C is the auto-zero period during which the A/D Converter input is shorted to ground, via Q38, to insure that the A/D starts from zero for each new integrate period.

4-56. If the 1 volt input during period A is not present, Q38 may be shorting the input to ground or Q31 may not be closing to apply the buffer output to the A/D. Time period B may indicate that the reference is low by not going to –1 volt. A low reference supply would also cause period B to lengthen. If the voltage level during time period B is unstable, the reference supply input FET Q35 or control Q34 may be faulty.

4-57. If the waveform at TP1 presents the proper 100 ms +1 volt indication during A then drops to –1 volt at the start of B but remains at –1 volt through C, the A/D Converter may not be supplying the control IC (U11) with the compare signal (CM). The compare signal can be checked at TP17 using the following procedure.

1. Connect the oscilloscope input to TP17.

2. The scope presentation shown in Figure 4-4 represents the proper compare signal for an 8810A input of +1 volt dc.

3. If this signal is present at TP17 proceed to control signal troubleshooting, in the following paragraphs.

4. If the compare pulse is not present or incorrect, either in amplitude or timing of the leading edge make the following check.

5. Move the oscilloscope input to TP2. The scope presentation should be as shown in Figure 4-5.

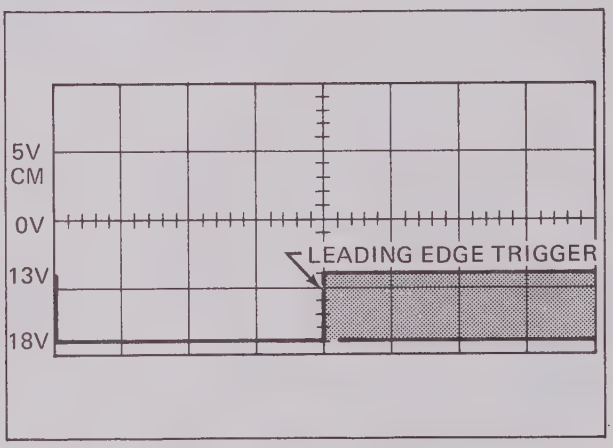


Figure 4-4. TP17 Compare Signal

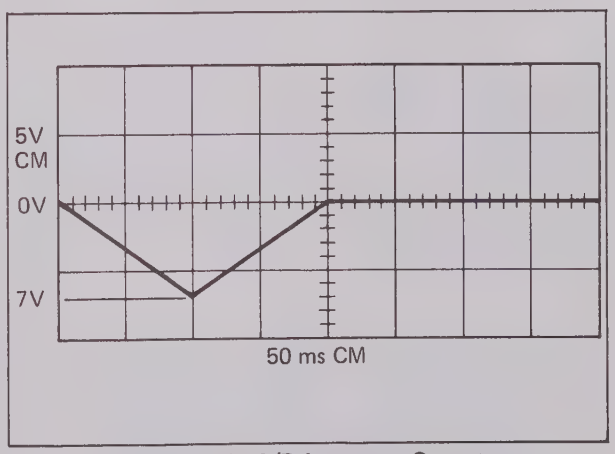


Figure 4-5. A/D Integrator Output

4-58. The probable cause for an improper signal at TP2 would be a failure in Q40 or U4. If the voltage level remains at zero volts, the protection transistor, Q59, may be shorted or input FET Q39 open.

4-59. The timing signals that control the processing of inputs applied to the 8810A are developed within the custom IC, U11. A 1 MHz crystal (Y1) provides the base frequency from which the timing control signals are produced. Figure 4-6 illustrates the timing relationship between the control signals (INT., DE (+R), AZ, and Δ 2), as they appear at RN3, and the integrator signal at TP2. An incorrect or missing control signal at RN3 may be caused by a failure in the logic control gates U13, U14, or U15.

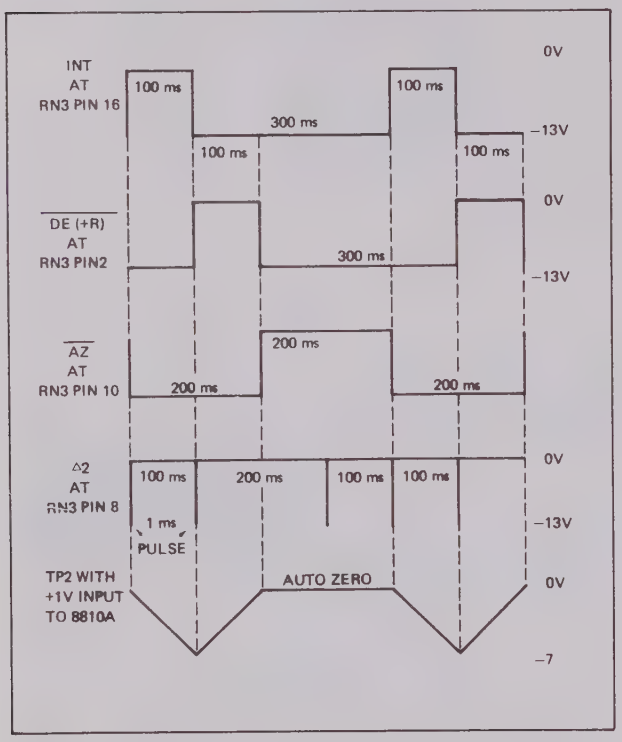


Figure 4-6. A/D Converter Control Signal Timing

4-60. The logic control gates (U13, U14, and U15) and the custom integrated circuit U11 use the 5 volt difference in potential between the –18 volt supply and –13 volt supply for the logic control signal levels. The recommended method for observing the logic signals in this area is to attach the oscilloscope return to the INPUT LO terminal and watch the logic signals for level changes between –18 volt and –13 volt levels.

CAUTION

The oscilloscope return has been connected to the INPUT LO terminal for the waveform checks. For observation of the control signals on the pins of U11 or logic control gates (U13, U14, and U15) the oscilloscope return can be connected to TP8, the –18 volt supply. If this connection is made, insure that the oscilloscope return will not ground the –18 volt power supply. Damage to the 8810A circuitry WILL result from grounding TP8.

4-61. REPAIR NOTES

CAUTION

Static discharge can damage MOS components contained in the 8810A. To prevent this possibility during repair use the precautions given earlier under Troubleshooting.

4-62. If, during the course of repair, VDC Buffer components, Q14, Q15 and/or U1, are replaced, it will be necessary to also select and replace resistors R34 and R38. These resistors, when properly selected, allow the DC ZERO pot to rest at approximately mid-range after adjustment. Use the following procedure to select R34 and R38.

1. Using a digital voltmeter (DVM) capable of reading 1V dc with 1 μV resolution (Fluke Model 8400A, 8800A or equivalent) connect this low input lead to the 8810A LO INPUT terminal. Connect its high input to TP13 as shown in Figure 4-2.

2. Mechanically center the 8810A front panel DC ZERO pot (R37).

3. Energize the 8810A and select the VDC function, 200 mV range.

4. Connect a short between the 8810A HI-LO INPUT terminals.

5. Connect a shorting jumper across R34 and R38. See Figure 5-2. The digital voltmeter should read between –0.05000 to +0.05000V dc. Record the reading.

6. Replace the short between the HI-LO INPUT terminals with a 1 megohm ±5% resistor and a 0.1 μF ±10% capacitor connected in parallel.

7. Adjust the BIAS ADJ pot (R30) for a display reading equal to the digital voltmeter reading recorded in step 5 (±5 digits).

8. Replace the resistor/capacitor at the INPUT terminals with a short circuit.

9. Observe the current digital voltmeter reading and complete the resistor selection procedure given in Table 4-6.

4-63. Use the following procedure to check the common mode rejection ratio of the repaired VDC Buffer:

1. Select the 20 VDC range on the 8810A.
2. Connect a digital voltmeter (1 μV resolution) between the 8810A's HI INPUT (DVM low input) and TP6 (DVM high input).
3. Connect a short between the 8810A HI-LO INPUT terminals and record the reading on the DVM.
4. Remove the short and apply +21V dc to the 8810A HI-LO INPUT terminals. The display on the 8810A should flash 18.888.
5. Compare the current DVM reading with that recorded in step 3. The difference should be less than 40 μV.
6. Reverse the input connections to the 8810A. The display should now flash –18.888.
7. Compare the current DVM reading with that taken in step 3. The difference should be less than 40 μV.

Table 4-6. Resistor Selection Procedure

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	Is the absolute reading taken from the digital voltmeter in step 9 of paragraph 4-62 equal to or greater than .002100?	8	2	
2	Is the offset voltage positive?	3	4	
3	Select resistor value from Table 4-8 and install resistor in position A (R38) on the Main PCB Assembly (remove short).			5
4	Select resistor value from Table 4-8 and install resistor in position B (R34) on the Main PCB Assembly (remove short).			5
5	Set the DC ZERO pot (R37) to both the cw and ccw extremes. Note the digital voltmeter reading at both settings.			6
6	Is the smallest digital voltmeter reading equal to or less than .000100?	15	7	
7	Mechanically center the DC ZERO pot (R37).			2
8	Is offset voltage positive?	9	14	
9	Select resistor value from Table 4-7 and install resistor in position A (R38) on the Main PCB Assembly (remove short).			10
10	Complete the DC Bias adjustment procedure as given earlier under Calibration Adjustments.			11
11	Is the digital voltmeter reading between .000000 and –.002100?	3	9	
12	Select resistor value from Table 4-7 and install resistor in position B (R34) on the Main PCB Assembly (remove short).			13
13	Complete the DC Bias adjustment procedure as given earlier under Calibration Adjustments.			14
14	Is the digital voltmeter reading between .000000 and +.002100?	4	12	
15	Adjust DC ZERO pot for an 8810A display of 00.000 ± 1 digit.			16
16	Test the CMRR characteristics of the repaired VDC Buffer using the procedure given under VDC Buffer CMRR.			–

Table 4-7. Offset Voltage Correction Resistors (Coarse)

OFFSET VOLTAGE	COARSE RESISTOR	J.F. P/N	TOL. %	TEMPERATURE COEFFICIENT
0.00000 - 0.00200	None	------		
0.00201 - 0.00400	31.6k	261610	1%	T0
0.00401 - 0.00600	47.5k	289546	1%	T0
0.00601 - 0.00800	63.4k	235382	1%	T0
0.00801 - 0.01000	80.6k	281121	1%	T0
0.01001 - 0.01200	95.3k	289561	1%	T0
0.01201 - 0.01400	113 k	379065	1%	T2
0.01401 - 0.01600	130 k	379073	1%	T2
0.01601 - 0.01800	147 k	379081	1%	T2
0.01801 - 0.02000	162 k	379099	1%	T2
0.02001 - 0.02200	178 k	379107	1%	T2
0.02201 - 0.02400	196 k	379115	1%	T2
0.02401 - 0.02600	215 k	379123	1%	T9
0.02601 - 0.02800	232 k	257527	1%	T9
0.02801 - 0.03000	249 k	379131	1%	T9
0.03001 - 0.03200	267 k	379149	1%	T9
0.03201 - 0.03400	287 k	257543	1%	T9
0.03401 - 0.03600	301 k	379156	1%	T9
0.03601 - 0.03800	316 k	379164	1%	T9
0.03801 - 0.04000	340 k	379172	1%	T9
0.04001 - 0.04200	357 k	312793	1%	T9
0.04201 - 0.04400	374 k	379180	1%	T9
0.04401 - 0.04600	392 k	260455	1%	T9
0.04601 - 0.04800	412 k	379198	1%	T9
0.04801 - 0.05000	432 k	379206	1%	T9

Table 4-8. Offset Voltage Correction Resistors (Fine)

OFFSET VOLTAGE	FINE RESISTOR	J.F. P/N	TOL%	TEMPERATURE COEFFICIENT
0.00000 - 0.00010	None	------		
0.00011 - 0.00030	1.54k	289066	1%	T0
0.00031 - 0.00051	3.09k	235150	1%	T0
0.00051 - 0.00071	4.75k	260679	1%	T0
0.00071 - 0.00091	6.19k	283911	1%	T0
0.00091 - 0.00110	7.68k	370999	1%	T0
0.00110 - 0.00130	9.31k	379040	1%	T0
0.00131 - 0.00150	10.7k	293613	1%	T0
0.00151 - 0.00170	12.4k	261644	1%	T0
0.00171 - 0.00191	14.0k	379057	1%	T0
0.00191 - 0.00210	16.9k	267146	1%	T0

Section 5
List of Replaceable Parts

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5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. Components are listed alpha-numerically by assembly. Electrical components are listed by reference designation and mechanical components are listed by item number. Each listed part is shown in accompanying illustration.

5-3. Parts lists include the following information:

a. Reference Designation or Item Number.

b. Description of each part.

c. Fluke Stock Number.

d. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Names list.)

e. Manufacturer's part Number or Type.

f. Total Quantity per assembly or component.

g. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one in each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc, that are not always part of the instrument, or are deviations from the basic instrument mode, the REC QTY column lists the recommended quantity of the item in that particular assembly.

h. Use Code is provided to identify certain parts that have been added, deleted or modified during production of the instrument.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

a. Quantity

b. FLUKE Stock Number

c. Description

d. Reference Designation or Item Number

e. Printed Circuit Board Part Number and Revision Letter

f. Instrument Model and Serial Number

Table 5-1. Final Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FINAL ASSEMBLY, 8810A FIGURE 5-1						
A1	MAIN PCB ASSEMBLY (8800A-4001T)	366245	89536	366245	1		
A2	FRONT PANEL ASSEMBLY (8810A-4201)	472407	89536	472407	1		
F1	FUSE, 1/4 AMP, 250V (INCLUDES SPARE F1)	109314	71400	AGC1-4	2	10	
MP1	BRACKET, REAR SUPPORT	384297	89536	384297	1		
MP2	CASE, MOLDED	363655	89536	363655	1		
MP3	CHASSIS, SIDE ASSEMBLY	372227	89536	372227	1		
MP4	CHASSIS, SIDE	388264	89536	388264	1		
MP5	CRANK AND ROD ASSEMBLY	378968	89536	378968	1		
	BEARING, CRANK	376996	89536	376996	1		
MP6	DECAL, HANDLE	347401	89536	347401	2		
MP7	DECAL, GEN. SPEC	477505	89536	477505	1		
MP8	E RETAINING RING (NOT ILLUSTRATED)	168914	79136	5133-15-MDR	1		
MP9	GUARD, BOTTOM	364901	89536	364901	1		
MP10	GUARD, INSULATOR	384289	89536	384289	2		
MP11	GUARD, TOP	462812	89536	462812	1		
MP12	GUARD, XFMR	365114	89536	365114	1		
MP13	HANDLE, MOLDED	414581	89536	414581	1		
MP14	LENS	401604	89536	401604	1		
MP15	LINE CORD (NOT ILLUSTRATED)	343723	89536	343723	1	1	
MP16	LINE SWITCH	380121	89536	380121	1		
MP17	PAD, FOOT	338632	89536	338632	2		
MP18	SCREW, 6-20 X 3/8	288266	89536	288266	2		
MP19	WASHER, FLAT, HANDLE	340505	89536	340505	2		
MP20	LOCKOUT, FUNCTION SWITCH	480384	89536	480384	1		
T1	XFMR, POWER				1		
	115/230V AC	373977	89536	373977			
	100V AC	395194	89536	395194			
U11	⊗IC, PMOS, UNIVERSAL DVM	407734	89536	407734	1	1	
XF1	FUSEHOLDER	103283	71400	4405	1		

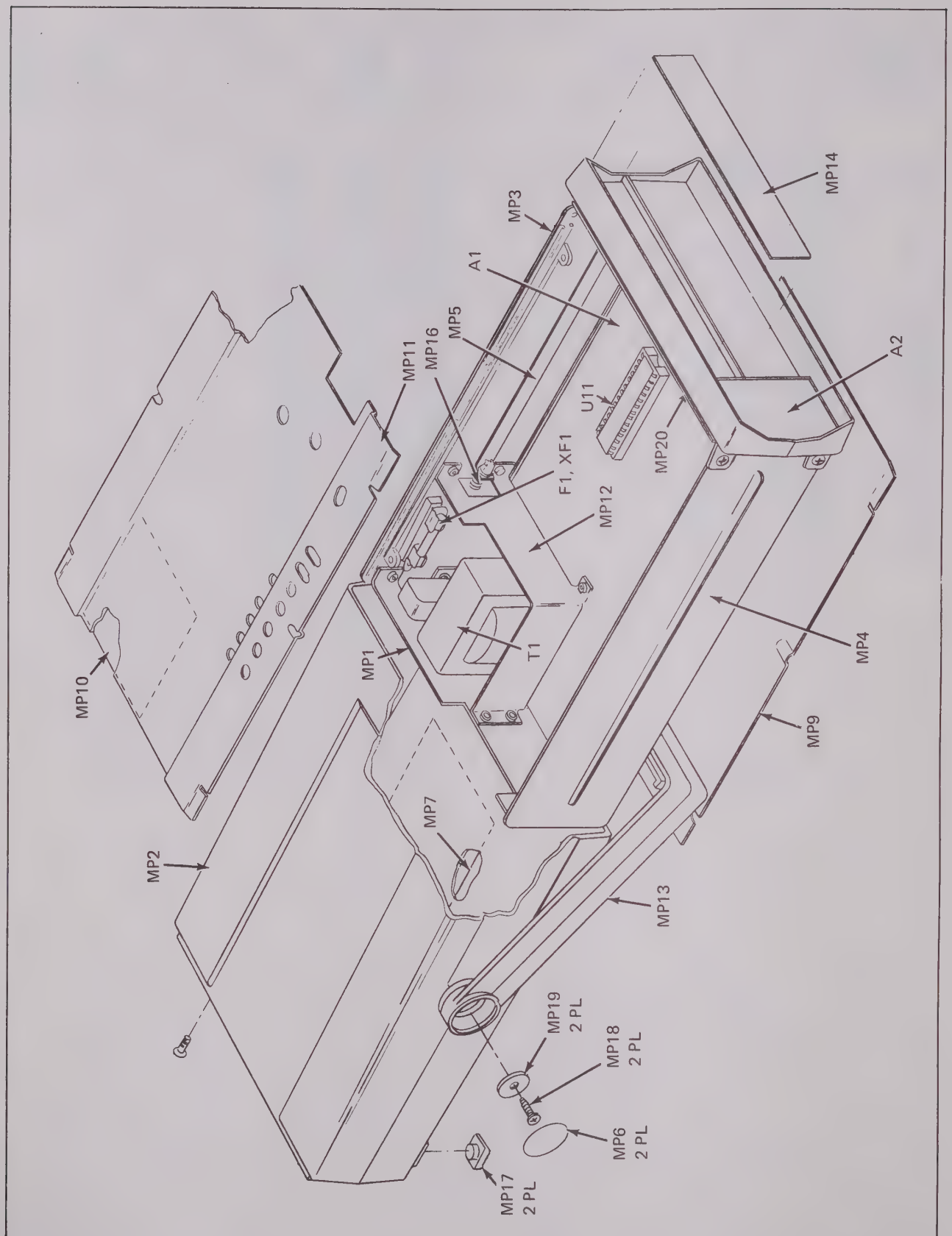

Figure 5-1. Final Assembly

Table 5-2. A1 Main PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	MAIN PCB ASSEMBLY (8800A-4001T) FIGURE 5-2	366245	89536	366245	REF		
C2	CAP, PLSTC, 0.022 UF +/-10%, 100V	333823	84411	863UW22391	1		
C3	CAP, CER, 0.0005 UF +/-20%, 50V	175232	56289	C023B101E502M	2		
C4	CAP, CER, 0.0005 UF +/-20%, 50V	175232	56289	C023B101E502M	REF		
C5	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	4		
C6	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C7	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	5		
C8	CAP, POLY CAR, 0.10 UF +/-10%, 100V	459990	73445	C280MCH/A100K	1		
C9	CAP, POLY PROP, 0.47 UF +/-5%, 50V	364042	01281	JF78B	1		
C10	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C11	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
C12	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C13	CAP, POLY CAR, 2.2 UF +/-10%, 250V	306522	73445	C280MCH/A2M2	1		
C15	CAP, CER, .0012 UF +/-10%, 500V	106732	71590	CF122	1		
C16	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	2		
C17	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C18	CAP, ELECT, 50 UF +75/-10%, 50V	105122	56289	30D506G050DD4	2	1	
C19	CAP, ELECT, 50 UF +75/-10%, 50V	105122	56289	30D506G050DD4	REF		
C20	CAP, ELECT, 220 UF +50/-10%, 40V	178616	73445	ET221X040A01	2	1	
C21	CAP, ELECT, 220 UF +50/-10%, 40V	178616	73445	ET221X040A01	REF		
C22	CAP, ELECT, 4000 UF +100/-10%, 10V	330761	25088	B41010-4700/10	1	1	
C23	CAP, TA, 4.7 UF +/-20%, 20V	161943	56289	196D475X0025JA1	3		
C24	CAP, MICA, 100 PF +/-5%, 500V	148494	72136	DM15F101J	1		
C25	CAP, TA, 4.7 UF +/-20%, 20V	161943	56289	196D475X0025JA1	REF		
C26	CAP, TA, 4.7 UF +/-20%, 20V	161943	56289	196D475X0025JA1	REF		
C27	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
C28	CAP, CER, 33 PF +/-2%, 100V	354952	32897	8121A100C0G330G	REF		
C29	CAP, MICA, 270 PF +/-5%, 500V	148452	72136	DM15F271J	1		
C31	CAP, MINI CER, 68 PF +/-2%, 100V	362756	80031	222263110689	1		
C32	CAP, MINI CER, 15 PF +/-2%, 100V	369074	80031	222263110159	1		
C33	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
CR6	DIODE, SI	180554	07910	TD12599	1	1	
CR7	DIODE ZENER, 22V	181073	07910	1N969B	2	1	
CR8	DIODE ZENER, 22V	181073	07910	1N969B	REF		
CR9	DIODE, SI	375485	09214	MPD300	2	1	
CR10	DIODE, SI	375485	09214	MPD300	REF		
CR11	DIODE, ZENER, 6.2V	325811	07910	1N735A	4	1	
CR12	DIODE, ZENER, 6.2V	325811	07910	1N735A	REF		
CR13	DIODE, ZENER, 13V	110726	07910	1N964B	1	1	
CR16	DIODE, SI	203323	07910	1N4148	13	3	
CR18	DIODE, SI	203323	07910	1N4148	REF		
CR19	DIODE, SI	203323	07910	1N4148	REF		
CR20	DIODE, SI	203323	07910	1N4148	REF		
CR21	DIODE, SI	203323	07910	1N4148	REF		
CR22	DIODE, SI	203323	07910	1N4148	REF		
CR23	DIODE, SI	203323	07910	1N4148	REF		
CR24	DIODE, SI	203323	07910	1N4148	REF		
CR25	DIODE, SI	203323	07910	1N4148	REF		
CR26	DIODE, SI	203323	07910	1N4148	REF		
CR29	DIODE, BRIDGE	296509	09423	FB200	3	1	
CR30	DIODE, BRIDGE	296509	09423	FB200	REF		
CR31	DIODE, BRIDGE	296509	09423	FB200	REF		
CR32	DIODE, SI	203323	07910	1N4148	REF		
CR33	DIODE, SI	203323	07910	1N4148	REF		
CR34	DIODE, ZENER, 10V	113324	07919	1N961A	2	1	
CR35	DIODE, ZENER, 6.2V	325811	07910	1N735A	REF		
CR36	DIODE, ZENER, 6.2V	325811	07910	1N735A	REF		
CR37	DIODE, 2 PELLET	375477	09213	MPD200	1	1	
CR38	DIODE, ZENER, 10V	113324	07919	1N961A	REF		
CR39	DIODE, SI	203323	07910	1N4148	REF		
K5	RELAY, TELEPHONE TYPE, 2-POLE	357707	26806	AZ42012201	1		
MP1	CONN, POST	376574	00779	5166-333-68	16		
MP2	HEAT SINK, XSTR	370155	05820	204-CB	1		
MP3	HEAT SINK, XSTR	418384	13103	2225B	2		
MP4	SOCKET, 40-PIN	376244	23880	TSA3100-40W	1		
MP5	SOCKET, 16-PIN	276535	23830	TSA2900-16W	3		
MP6	SOCKET, 14-PIN	276527	23880	TSA2900-14W	4		

Table 5-2. A1 Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP7	TERMINAL, FEED THRU	281865	12615	SL841-777	2		
MP8	TRANSIPAD, XSTR	152207	07047	10123-DAP	5		
Q10	XSTR, NPN	168716	12040	ST07154	3	1	
Q11	XSTR, PNP	269076	04713	2N4890	2	1	
Q12	XSTR, NPN	150359	86684	2N3053	1	1	
Q13	XSTR, NPN	168716	12040	ST07154	REF		
Q14	XSTR, SI, NPN	295717	24355	AD81100-17	1	1	
Q15	XSTR, DUAL, NPN	284075	32293	1T1099	1	1	
Q16	XSTR, SI, NPN	218396	04713	2N3904	20	5	
Q18	XSTR, FET, N-CHANNEL	370072	12040	KE4393	4	1	
Q19	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q20	XSTR, FET, N-CHANNEL	370072	12040	KE4393	REF		
Q21	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q22	XSTR, SI, PNP	195974	04713	2N3906	4	1	
Q23	XSTR, FET, N-CHANNEL	370072	12040	KE4393	REF		
Q24	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q25	XSTR, FET, N-CHANNEL	370072	12040	KE4393	REF		
Q26	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q27	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q28	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q29	XSTR, FET, N-CHANNEL	343830	89536	343830	6	2	
Q30	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q31	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q32	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q33	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q34	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q35	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q36	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q37	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q38	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q39	XSTR, FET	386730	89536	386730	1	1	
Q40	XSTR, FET, DUAL	257501	89536	257501	1	1	
Q41	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q42	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q43	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q44	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q45	XSTR, SI, PNP	340026	04713	MPS6563	6	2	
Q46	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q47	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q48	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q49	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q50	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q51	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q52	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q53	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q54	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q55	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q56	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q57	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q58	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q59	XSTR, NPN	168716	12040	ST07154	REF		
Q60	XSTR, SI, PNP	203364	07263	2N3638	2	1	
Q61	XSTR, SI, PNP	203364	07263	2N3638	REF		
Q62	XSTR, SI, NPN	218081	04713	MPS6520	1	1	
Q63	XSTR, PNP	269076	04713	2N4890	REF		
R21	RES, VAR, 200 +/-10%, 1/2W	275743	89536	275743	1	1	
R23	RES, COMP, 100K +/-5%, 2W	285056	01121	HB1045	1		
R25	RES, MF, 383 +/-1%, 1/8W	375899	91637	MFF1-83830F	1		
R26	RES, CAR, 62K +/-5%, 1/4W	348904	80031	CR251-4-5P62KTS	1		
R27	RES, MF, 205 +/-1%, 1/8W	325647	91637	MFF1-82050F	1		
R28	RES, CAR, 220 +/-5%, 1/4W	342626	80031	CR251-45P220ETS	2		
R29	RES, COMP, 100M +/-10%, 1/2W	190520	01121	EB1071	1		
R30	RES, VAR, 100K +/-10%, 1/2W	369520	89536	369520	1	1	
R31	RES, MF, 499K +/-1%, 1/8W	268813	91637	MFF1-84993F	1		
R32	RES, CAR, 220 +/-5%, 1/4W	342626	80031	CR251-45P220ETS	REF		
R33	RES, MF, 309K +/-1%, 1/8W	235283	91637	MFF1-83093F	2		
R35	RES, SET 2 PC	290320	89536	290320	1	1	
R36	RES, MF, 309K +/-1%, 1/8W	235283	91637	MFF1-83093F	REF		

Table 5-2. A1 Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R37	RES. VAR. 2K +/-10%. 1/2W	285163	89536	285163	1	1	
R39	RES. SET 2 PC	290320	89536	290320	REF		
R40	RES. MF.2.8M +/-1%. 1/2W	236703	91637	MFF1-22804F	1		
R41	RES. CAR. 10K +/-5%. 1/4W	348839	80031	CR251-45P10KT-S	3		
R42	RES. CAR. 150 +/-5%. 1/4W	343442	80031	CR251-4-5P150ETS	1		
R43	RES. CAR. 10K +/-5%. 1/4W	348839	80031	CR251-45P10KT-S	REF		
R45	RES. CAR. 1M +/-5%. 1/4W	348987	80031	CR251-4-5P1MTS	3		
R47	RES. VAR. 20 +/-20%. 1/2W	275727	71450	360T200B	1	1	
R48	RES. SET. 2 PC	363788	89536	363788	1		
R52	RES. SET. 2 PC	363788	89536	363788	REF		
R53	RES. MF. 100K +/-1%. 1/8W	248807	91637	MFF1-81003F	1		
R54	RES. MF. 9.76K +/-1%. 1/8W	241489	91637	MFF1-89761F	1		
R55	RES. COMP. 1.5K +/-5%. 1/4W	148031	01121	CB1525	1		
R56	RES. CAR. 1M +/-5%. 1/4W	348987	80031	CR251-4-5P1MTS	REF		
R74	RES. CAR. 4.7K +/-5%. 1/4W	348821	80031	CR251-45P4K7TS	1		
R75	RES. MF. 30.9K +/-1%. 1/8W	235275	91637	MFF1-83092F	1		
R76	RES. COMP. 10M +/-5%. 1/4W	194944	01121	CB1065	1		
R77	RES. MF. 64.9K +/-1%. 1/8W	288530	91637	MFF1-86492F	2		
R78	RES. VAR. 200 +/-10%. 1/2W	285148	71450	360S201A	1	1	
R79	RES. MF. 46.4K +/-1%. 1/8W	188375	91637	MFF1-84642F	1		
R80	RES. MF. 64.9K +/-1%. 1/8W	288530	91637	MFF1-86492F	REF		
R83	RES. CAR. 51K +/-5%. 1/4W	376434	80031	CR251-4-5P51KTS	1		
R84	RES. MF. 4.99K +/-1%. 1/8W	168252	91637	MFF1-84991F	1		
R85	RES. MF. 200K +/-1%. 1/8W	261701	91637	MFF1-82003F	1		
R86	RES. CAR. 3.3K +/-5%. 1/4W	348813	80031	CR251-45P3K3TS	1		
R87	RES. CAR. DEP. 2.7K +/-5%. 1/4W	386490	80031	CR251-45P2K7TS	1		
R88	RES. VAR. 5K +/-10%. 1/2W	288282	89536	288282	1		
R89	RES. CAR. 100 +/-5%. 1/4W	348771	80031	CR251-4-5P100-ETS	1		
R90	RES. CAR. 2.2K +/-5%. 1/4W	343400	80031	CR251-45P2K-2TS	2		
R91	RES. SET 6 PC	363804	89536	363804	1		
R92	RES. SET 6 PC	363804	89536	363804	REF		
R93	RES. SET 6 PC	363804	89536	363804	REF		
R94	RES. SET 6 PC	363804	89536	363804	REF		
R95	RES. SET 6 PC	363804	89536	363804	REF		
R96	REF AMP. SET (INCLUDES R102 & U9)	450080	89536	450080	1	1	
R97	RES. VAR. 20 +/-20%. 1/2W	285114	71450	360S200B	2	1	
R98	RES. SET 6 PC	363804	89536	363804	REF		
R99	RES. VAR. 20 +/-20%. 1/2W	285114	71450	360S200B	REF		
R100	RES. SUB MINI. WW. 14K +/-0.1%. .1W	363770	54294	SP21D22-14KB	1	1	
R101	RES. MF. 3.74K +/-1%. 1/8W	272096	91637	MFF1-83741F	1		
R102	REF AMP. SET (INCLUDES R96 & U9)	450080	89536	450080	REF		
R103	RES. MF. 6.34K +/-1%. 1/8W	267344	91637	MFF1-86341F	1		
R113	RES. MF. 5.49K +/-0.1%. 1/8W	375873	91637	MFF1-85491-BS	1		
R114	RES. MF. 3.48K +/-0.1%. 1/8W	375881	91673	MFF1-83481BS	1		
R115	RES. MF. 10K +/-1%. 1/8W	168260	91637	MFF1-81102F	1		
R116	RES. CAR. 10K +/-5%. 1/4W	348839	80031	CR251-45P10KT-S	REF		
R117	RES. CAR. 1M +/-5%. 1/4W	348987	80031	CR251-4-5P1MTS	REF		
R118	RES. MF. 10.08K +/-0.1%. 1/8W	346908	91637	MFF1-810R8-R1PCT	2		
R119	RES. MF. 10.08K +/-0.1%. 1/8W	346908	91637	MFF1-810R8-R1PCT	REF		
R120	RES. CAR. 2.2K +/-5%. 1/4W	343400	80031	CR251-45P2K-2TS	REF		
R121	RES. COMP. 6.8K +/-5%. 1/4W	148098	01121	CB6825	1		
RN1	RES. NETWORK	379248	89536	379248	1	1	
RN3	RES. NETWORK	379255	89536	379255	1	1	
RN4	RES. NETWORK	379230	89536	379230	1	1	
RN5	RES. NETWORK	358002	01121	FN260	1	1	
S12	SWITCH. SLIDE. 115/230V	376798	82389	11A437	1	1	
TP1	CONN. POST	379438	00779	8619405	17		
TP2	CONN. POST	379438	00779	8619405	REF		
TP3	CONN. POST	379438	00779	8619405	REF		
TP4	CONN. POST	379438	00779	8619405	REF		
TP5	CONN. POST	379438	00779	8619405	REF		
TP6	CONN. POST	379438	00779	8619405	REF		
TP7	CONN. POST	379438	00779	8619405	REF		
TP8	CONN. POST	379438	00779	8619405	REF		
TP9	CONN. POST	379438	00779	8619405	REF		
TP10	CONN. POST	379438	00779	8619405	REF		
TP11	CONN. POST	379438	00779	8619405	REF		
TP12	CONN. POST	379438	00779	8619405	REF		

Table 5-2. A1 Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
TP13	CONN, POST	379438	00779	8619405	REF		
TP14	CONN, POST	379438	00779	8619405	REF		
TP16	CONN, POST	379438	00779	8619405	REF		
TP17	CONN, POST	379438	00779	8619405	REF		
U1	IC, OP AMP	284760	12040	LM308H	2	1	
U2	IC, OP AMP, J-FET INPUT	448985	89536	448985	1	1	
U3	IC, OP AMP, J-FET INPUT	381962	12040	SH61140	1	1	
U4	IC, OP AMP	363515	24355	AD301AN	2	1	
U5	IC, OP AMP	329912	12040	LM318H	1	1	
U6	IC, LINEAR, COMPARATOR	352195	32293	LM311PA	1	1	
U7	IC, OP AMP	284760	12040	LM308H	REF		
U8	IC, OP AMP	225961	34333	SG8023	1	1	
U9	REF AMP, SET (INCLUDES R96 & R102)	450080	89536	450080	REF		
U11	SEE FINAL ASSEMBLY						
U12	IC, BCD-TO-DECIMAL DECODER	293142	01295	SN7442N	1	1	
U13	Ⓢ IC, C-MOS, HEX	355214	95303	CD4009AE	1	1	
U14	Ⓢ IC, C-MOS, NAND	375147	95303	CD4023AE	1	1	
U15	Ⓢ IC, C-MOS, NAND	355198	95303	CD4011AE	1	1	
U16	IC, TTL, BCD DECODER/DRIVER	340109	01295	SN7447AN	1	1	
U17	IC, LINEAR, VOL REG	313106	07263	U5R7723393	1	1	
U18	IC, OP AMP	363515	24355	AD301AN	REF		
U19	IC, LINEAR, VOL REG	355107	07263	F7805UC	1	1	
U20	Ⓢ IC, C-MOS, MULTIPLEXER	375808	95303	CD4053AE	1	1	
W2	WIRE ASSY, BLACK	373779	89536	373779	1		
W3	WIRE ASSY, BLUE	378307	89536	378307	1		
W9	WIRE ASSY, RED	378299	89536	378299	1		
XK5	SOCKET RELAY	376665	12300	27E501	1		
Y	CONN, POST	379438	00779	8619405	REF		
Y1	CRYSTAL, QUARTZ, 1 MHZ	375493	89536	375493	1		

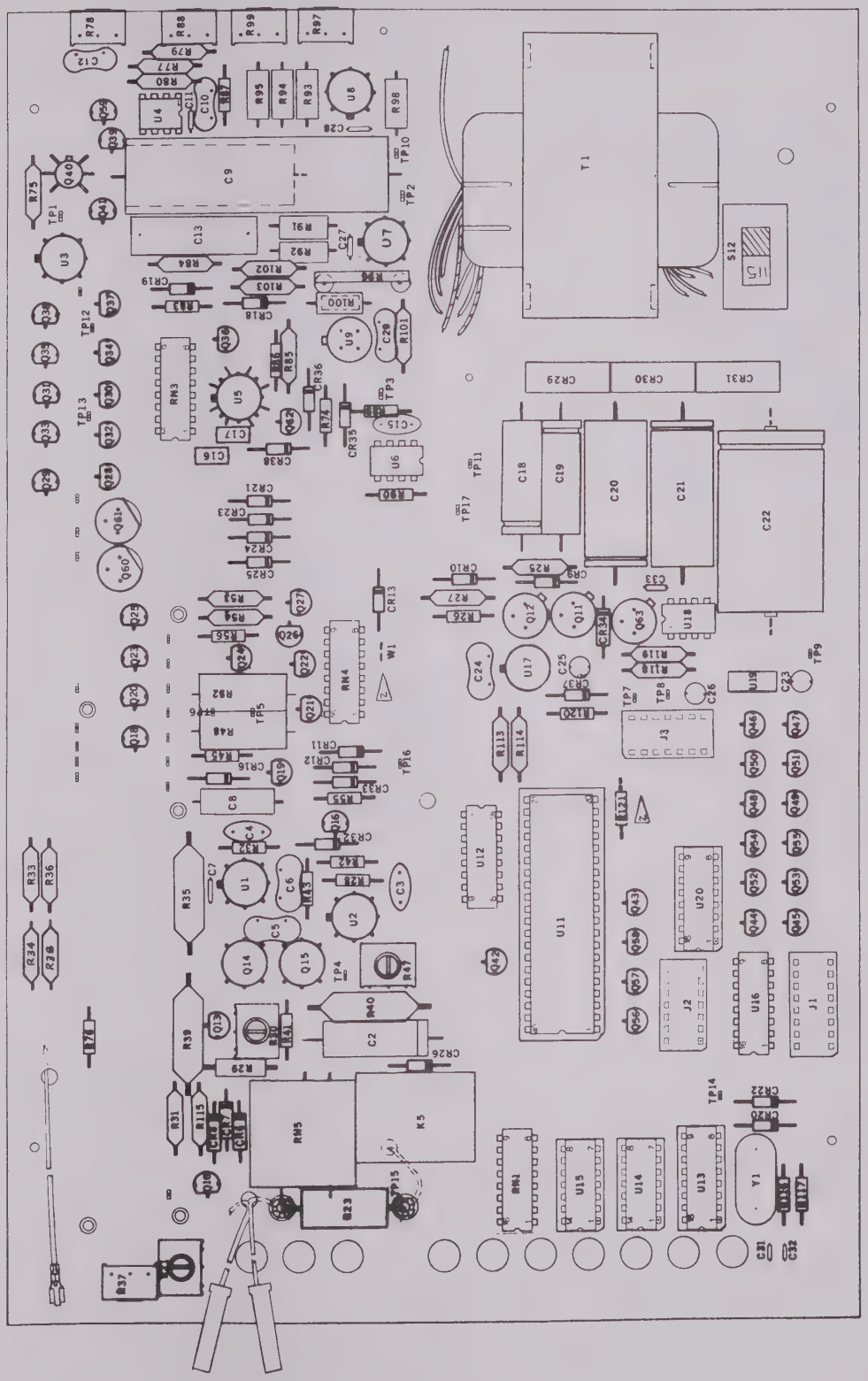

Figure 5-2. A1 Main PCB Assembly

Table 5-3. A2 Front Panel Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	FRONT PANEL ASSEMBLY (8810A-4201) FIGURE 5-3	472407	89536	472407	REF		
A2A1	DISPLAY PCB ASSEMBLY	366278	89536	366278	1		
MP1	ACTUATOR, SWITCH, GREEN	420604	89536	420604	1		
MP2	ACTUATOR, SWITCH, GREY	420596	89536	420596	10		
MP3	BINDING POST, BLACK	275560	32767	825-45	2		
MP4	BINDING POST, BLUE	275578	32767	825-55	1		
MP5	BINDING POST, RED	275552	32767	825-65	2		
MP6	CONNECTOR TAB	267609	00779	60837-1	1		
MP7	DECAL 1, FRONT PANEL	477513	89536	477513	1		
MP8	DECAL 2, FRONT PANEL	477521	89536	477521	1		
MP9	LINK, SHORTING	101220	24655	0938-9712	1		
MP10	NUT, NYLON, 6-32	111013	89536	89536	4		
MP11	PANEL, FRONT, MOLDED	477489	89536	477489	1		
MP12	RETAINING RING	355586	89536	355586	10		
MP13	SLUG, ACTUATOR	364745	89536	364745	11		
MP14	SPACER, NYLON	102665	89536	102665	8		

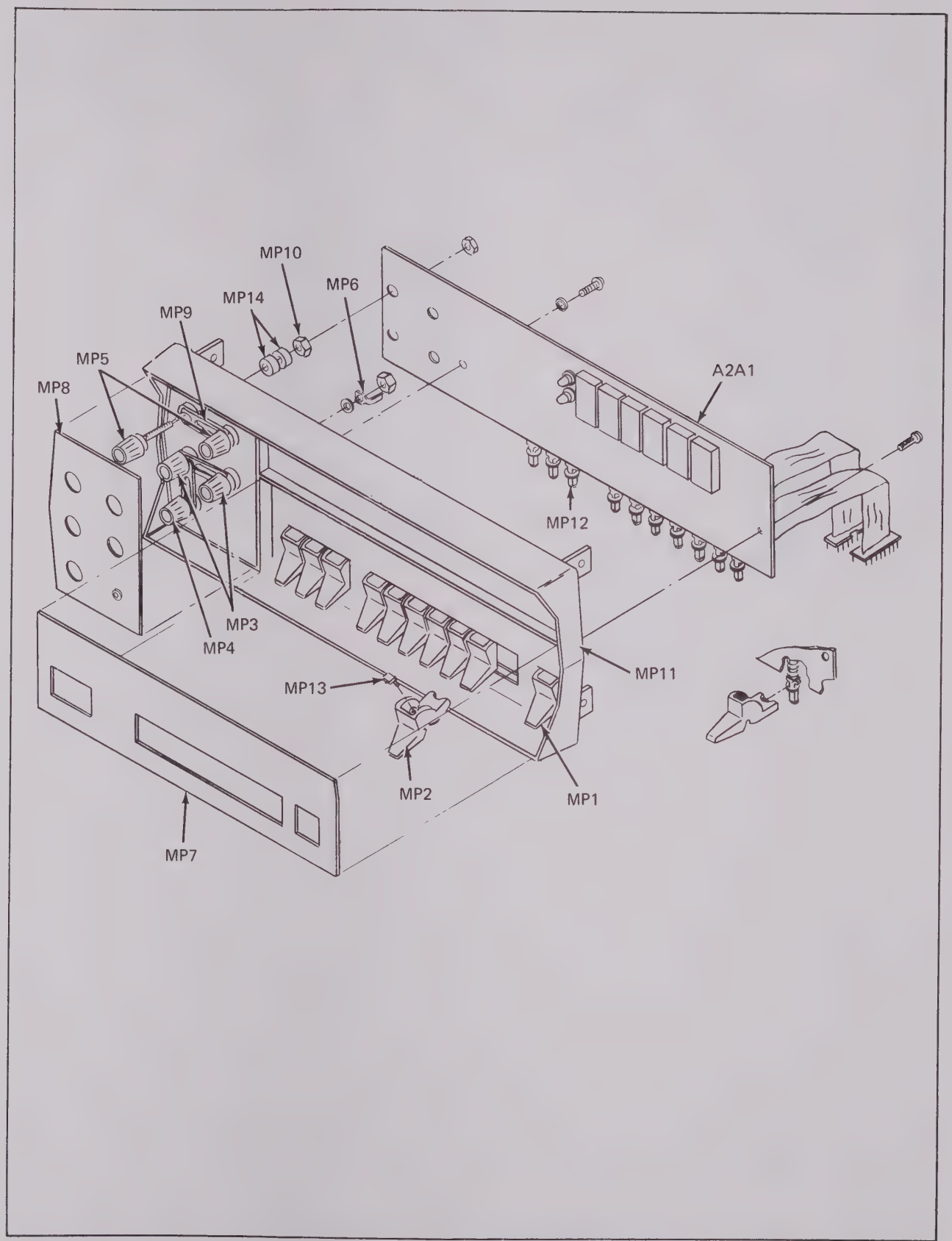

Figure 5-3. A2 Front Panel Assembly

Table 5-4. A2A1 Display PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2A1	DISPLAY PCB ASSEMBLY (8800A-4002) FIGURE 5-4	366278	89536	366278	REF		
C1	CAP, CER, 47 PF +/-10%, 2 KV/3.5 KV	282145	00656	HVD347P10PCT	1		
CR2	DIODE, LED	385914	89536	385914	2	1	
CR3	DIODE, LED	385914	89536	385914	REF		
DS1	DISPLAY, LED	472951	89536	472951		1	
DS2	DISPLAY, LED	429985	89536	429985	5	1	
DS3	DISPLAY, LED	429985	89536	429985	REF		
DS4	DISPLAY, LED	429985	89536	429985	REF		
DS5	DISPLAY, LED	429985	89536	429985	REF		
DS6	DISPLAY, LED	429985	89536	429985	REF		
MP1	CONN, POST	379438	00779	86144-5	9		
P1	CABLE ASSY, 16P	380576	89536	380576	1		
P2	CABLE ASSY, 14P	380568	89536	380568	1		
RN1	RES, NETWORK	381376	89536	381376	1	1	
S1	SWITCH ASSY	390500	89536	390500	1		
S2	SWITCH ASSY	390500	89536	390500	REF		
S3	SWITCH ASSY	390500	89536	390500	REF		
S4	SWITCH ASSY	390500	89536	390500	REF		
S5	SWITCH ASSY	390500	89536	390500	REF		
S6	SWITCH ASSY	390500	89536	390500	REF		
S7	SWITCH ASSY	390500	89536	390500	REF		
S8	SWITCH ASSY	390500	89536	390500	REF		
S9	SWITCH ASSY	390500	89536	390500	REF		
S10	SWITCH ASSY	390500	89536	390500	REF		

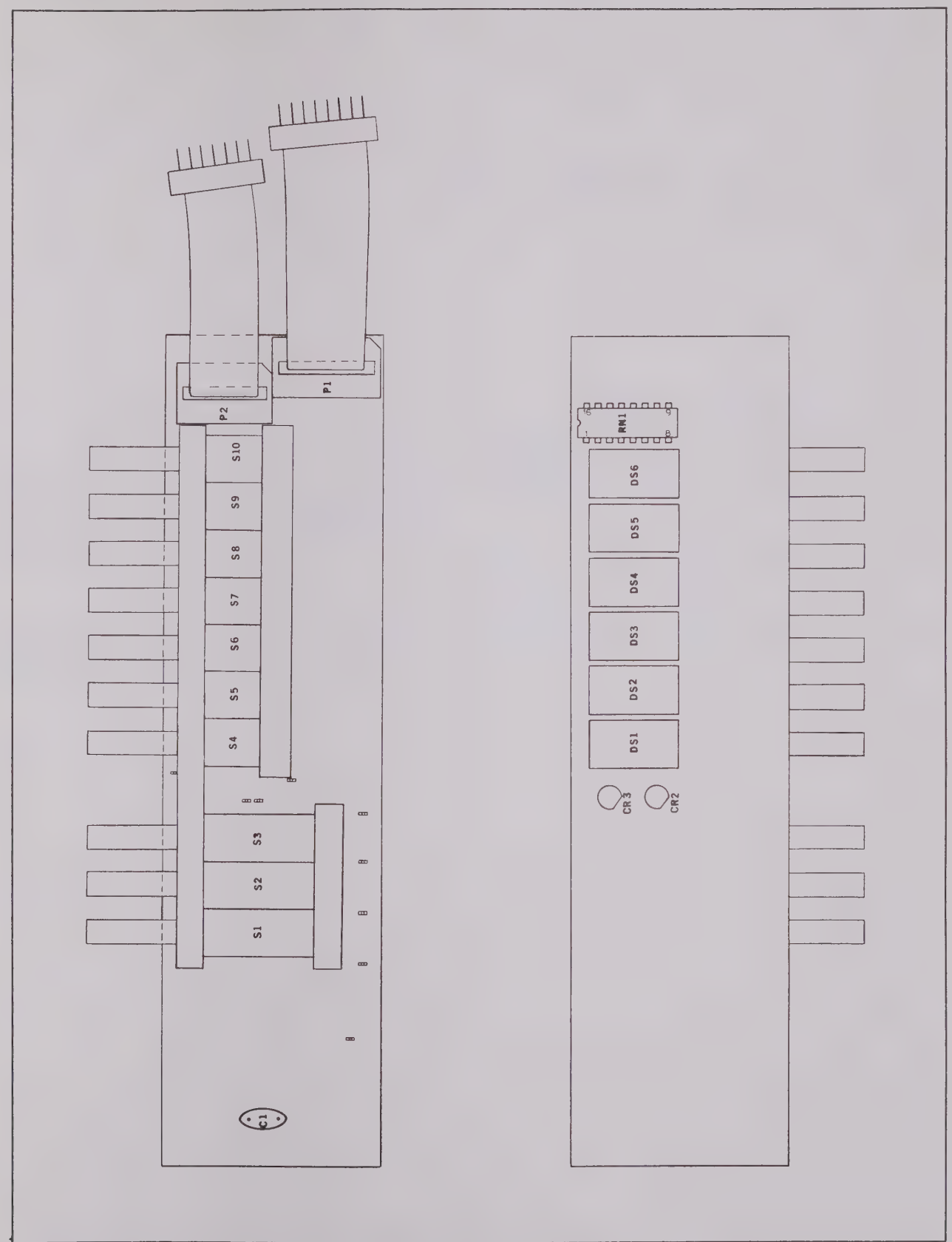

Figure 5-4. A2A1 Display PCB Assembly

Section 6
Option & Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains information concerning the options and accessories available for use with the Model 8810A. It consists of a series of subsections that include; introduction, accessories, and options. Each option and accessory is listed by Model or Option number in the table of contents on page 6-2.

6-3. Accessories include a rack mounting kit and several specialized probes. The probes are designed to extend the measurement characteristics of the 8810A to include temperature, high voltage, high current, and/or high frequency.

6-4. Each option for the 8810A is documented as an individual subsection. All of the information necessary to install, operate, and maintain an option is included in its subsection. This includes a list of replaceable parts and a schematic.

6-5. Each subsection is uniquely identified by page and paragraph numbering that relates to the accessories or a particular option. For example, a 600-X series identifies the general accessories subsection, and a 602-X series identifies the subsection for the -002 Option (where X is a sequential page or paragraph number).

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OPTION/MODEL	DESCRIPTION	PAGE
M00-200-625	Rack Mounting Kit	600-1
A80	Deluxe Testing Lead Kit	600-1
80T-150	Temperature Probe	600-1
80K-40	High Voltage Probe	600-2
81RF	High Frequency Probe	600-3
82RF	High Frequency Probe	600-3
-002	Digital Output Unit	602-1
-007	Ohms Converter	607-1
-008	AC Converter	608-1
-009	True RMS Converter	609-1

ACCESSORIES

600-1. RACK MOUNTING KIT

600-2. The 8810A can be rack-mounted in a standard 19-inch equipment rack using Rack Mounting Kit, M00-200-625. With reference to Figure 600-1, use the following procedure to install the Rack Mounting Kit.

a. Remove the handle disc decal and handle from the 8810A. Save the handle mounting screws for use later in this procedure.

b. Remove the case retaining screws from the 8810A (rear of the case) and remove the instrument from the case.

c. Insert the open end of the case into the rear opening on the center rack mount plate. Stop when the case is flush with the front surface of the plate. Fasten the rack mount brackets and retainers to the case as shown.

d. Secure the brackets and retainers to the handle mounting bosses using the handle mounting screws. Take care to avoid stripping the threads.

e. Position the instrument case on the center rack mount plate and fasten the brackets using the 6-32 nuts.

f. Re-install the instrument in the case and replace the case retaining screws.

600-3. DELUXE TEST LEAD KIT (A80)

600-4. The deluxe test lead kit, shown in Figure 600-2, contains two test leads with probes (red and black) and five pairs of universal probe tips. The probe tips include: alligator clips, test prod tips, pin tips, banana plug tips, and binding post lugs. A convenient plastic pouch is provided for storing the contents of the test lead kit.

600-5. TEMPERATURE PROBE (80T-150)

600-6. Introduction

600-7. The 80T-150 Temperature Probe (Figure 600-3) converts the 8810A into a direct-reading (1 mV dc/°) °C or °F thermometer. It is ideally suited for surface, ambient, liquid measurements, and lends itself easily to a wide range of design, troubleshooting, and evaluation applications. A rugged, fast-responding probe-tip with a 350V dc standoff makes the 80T-150 one of the most versatile and easy-to-use temperature probes available.

600-8. Specifications

Range (°C/°F field selectable by internal jumpers)	−50°C to +150°C or −58°F to 302°F
Accuracy	±1°C (1.8°F) from 0°C to 100°C, decreasing linearity to ±3°C (5.4°F) at −50°C and +150°C
Resolution	0.1°C on 200 mV range.
Voltage Standoff	350V dc or peak ac
Power	Internal disposable battery; 1,000 hours of continuous use.

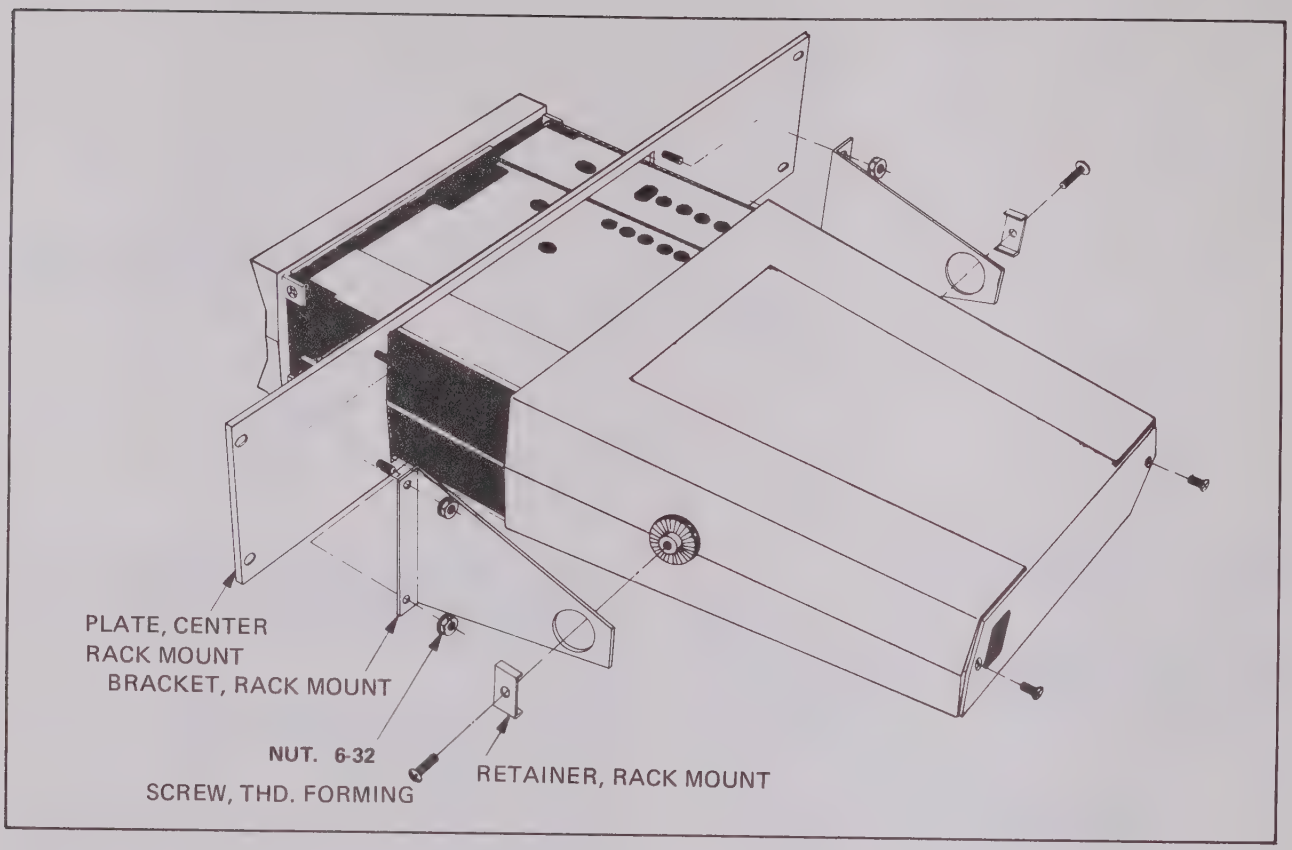


Figure 600-1. Rack Mount Installation

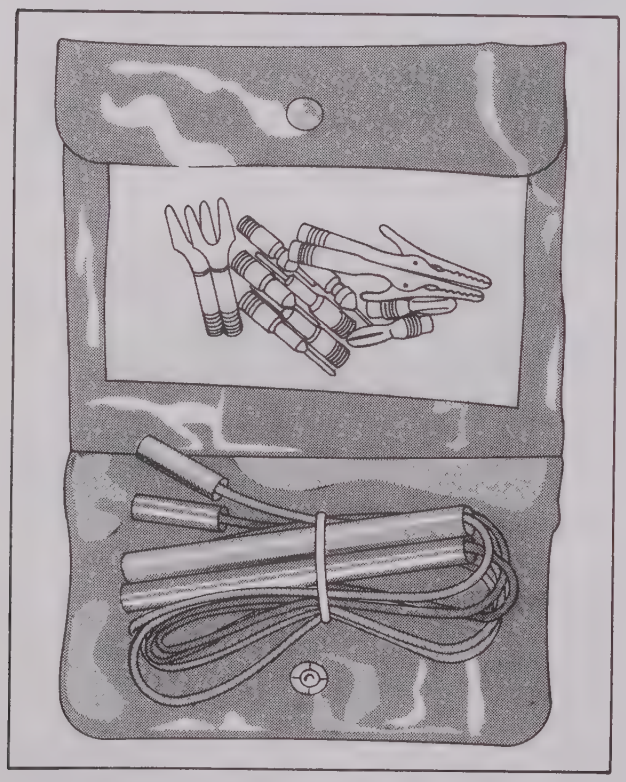


Figure 600-2. Deluxe Test Lead Kit (A80)

600-10. HIGH VOLTAGE PROBE (80K-40)

600-11. Introduction

600-12. The Model 80K-40 (Figure 600-3) extends the voltage measurement capability of the 8810A up to 40 kV. Internally, the probe contains a special 1000:1 resistive divider. Metal-film resistors with matched temperature coefficients comprise the divider, and provide the probe with its excellent accuracy and stability characteristics. Also, an unusually high input impedance (1000 MΩ) minimizes circuit loading, and thereby contributes to measurement accuracy.

600-13. Specifications

Voltage Range	1 kV to 40 kV dc or peak ac, 28 kV rms ac
Input Resistance	1000 MΩ
Division Ratio	10000:1
Accuracy DC	
Overall Accuracy	20 kV to 30 kV ± 2% (calibrated 1% at 25 kV).

Upper Limit	Changes linearly from 2% at 30 kV to 4% at 40 kV
Lower Limit	Changes Linearly from 2% at 20 kV to 4% at 1 kV
Accuracy AC (overall)	± 5% at 60 Hz

600-14. HIGH FREQUENCY PROBE (81RF)

600-15. Introduction

600-16. The 81RF Probe (Figure 600-3) extends the frequency range ofthe 8810A voltage measurements capability to include 100 kHz to 100 MHz input from 0.25 to 30V rms. It operates in conjunction with the 8810A dc voltage ranges, and provides a dc output that is calibrated to be equivalent to the rms value of a sinewave input.

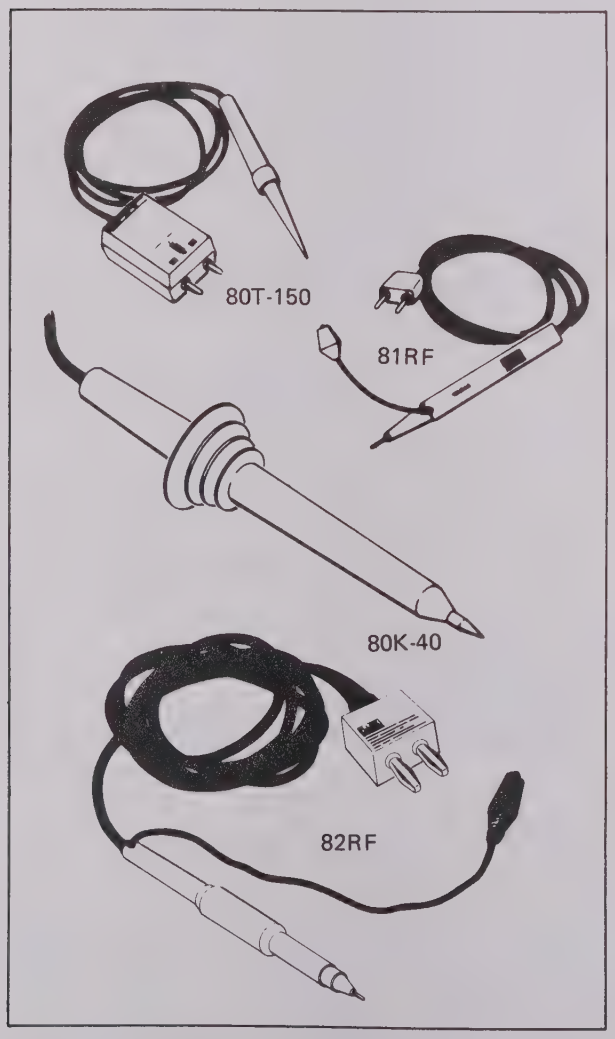


Figure 600-3. Accessory Probes

600-17. Specifications

AC-DC Transfer	±1 dB @ 30V, ±3 dB @ 2V, ±2 dB @ 0.25 to 0.5V.
Frequency Response	±1 dB from 100 kHz to 100 MHz
Extended Frequency Response	Useful for relative readings from 20 kHz to 250 MHz.
Response	Responds to peak value of input; calibrated to read rms value of a sinewave.
Voltage Range	0.25 to 30V rms
Maximum DC Input ...	350V dc
Input Impedance	12 MΩ shunted by 15 pF

600-18. HIGH FREQUENCY PROBE (82RF)

600-19. Introduction

600-20. The Model 82RF High Frequency Probe, Figure 600-3, allows measurements over a frequency range of 100 kHz to 500 MHz from 0.25 to 30V rms. It is designed to be used with voltmeters having an input impedance of 10 megohms ±10%. It may be used with a voltmeter having an input impedance higher than 10 megohms provided the input is externally shunted to make the equivalent input impedance equal to 10 megohms.

600-21. Circuitry within the 82RF consists of a capacitor-coupled rectifier circuit which responds to the peak value of the input waveform. The output is positive polarity dc which is calibrated to be equivalent to the rms value of a sinewave.

600-22. Specifications

Frequency Response	±1 dB from 100 kHz to 200 MHz; ±3 dB from 200 MHz to 500 MHz
Extended Frequency Response	Useful for relative readings from 20 kHz to 700 MHz
Response	Responds to peak value of input; calibrated to read rms value of a sinewave.
Voltage Range	0.25 to 30V rms
Maximum DC Input ...	200V dc
Input Impedance	2 MΩ shunted by 4 pF

Option -002
Digital Output Unit

602-1. INTRODUCTION

602-2. The Digital Output Unit (DOU), Option -002, is a factory installed pcb assembly designed to transfer bit-parallel measurement data (i.e., polarity, range, and magnitude) from the 8810A to an external hard-copy recorder. Along with the measurement data, appropriate handshaking I/O lines are included to insure accurate and expeditious data transfer. These include; Arm Enable, Arm Input, Busy, and Free Run. Output data is compatible with the Fluke Model 2010A Digital Printer. All input/output (I/O) data is electrically isolated from the 8810A measurement common.

602-3. SPECIFICATIONS

602-4. Specifications for the DOU are presented in Section 1 of this manual.

602-5. OPERATION

602-6. Once installed in the 8810A, the DOU requires no operator attention. However, certain considerations are necessary to properly interface the DOU with the external recorder. These are discussed in the following paragraphs.

602-7. Input/Output Connector

602-8. The DOU is supplied with a mating I/O connector for use in fabricating a DOU/recorder interface cable. The connector is a keyed, 44-pin, card-edge type and comes complete with a protective hood. A replacement connector is available from Fluke as Part No. 388983.

NOTE

If the DOU is being interfaced with a Fluke Model 2010A Printer, use of the Model 2010A-7015K interface kit is recommended. Contact your nearest Sales Representative for additional information.

602-9. Interface Information

602-10. The pin assignments for the DOU's I/O connector are shown in Table 602-1. Signal requirements and characteristics are defined in the following descriptions.

602-11. LOGIC LEVELS

602-12. All I/O data at the DOU connector is positive-true and TTL compatible. It is also electrically isolated from the 8810A measurement common. This allows the I/O Logic Common to be referenced directly to that of the external recorder.

600-13. CONTROL DATA

602-14. The DOU is equipped with four separate control lines for the solicitation, acquisition, and transfer of measurement data. These are: Arm Enable, Arm Input, Free Run and Busy. Under ideal interface conditions these lines are used to establish a handshaking arrangement between the DOU and the external recorder (see Figure 602-1). This controlled interaction between the two units ensures an accurate and expeditious transfer of data.

602-15. Arm Enable and Arm Input operate as a signal pair for use in remotely commanding a DOU update.

Table 602-1. DOU Connector/Signal Identification

DOU DATA NAME	DOU PIN NO.		DOU DATA NAME	REMARKS
+5V	1	A	LOGIC RETURN	
BUSY FLAG	2	B	ARM ENABLE	
POL FLAG	3	C	ARM INPUT	
$\overline{\text{BUSY}}$ FLAG	4	D	FREE RUN	
$\overline{\text{POL}}$ FLAG	5	E	NOT USED	
OVERLOAD Ω	6	F	a RANGE CODE	
RANGE CODE b	7	H	c RANGE CODE	
W6	8	J	X6 } 4 BITS	
Y6	9	K	Z6 } 6SD	
W5	10	L	X5 } 4 BITS	
Y5	11	M	Z5 } 5SD	
W4	12	N	X4 } 4 BITS	
Y4	13	P	Z4 } 4SD	
W3	14	R	X3 } 4 BITS	
Y3	15	S	Z3 } 3SD	
W2	16	T	X2 } 4 BITS	
Y2	17	U	Z2 } 2SD	
(GND) W1	18	V	X1 (GND) } 4 BITS MSD	
(GND) Y1	19	W	Z1 } ONE ACTIVE	
NOT USED	20	X	NOT USED	
	21	Y		
	22	Z		

BCD BIT WEIGHT
W = 8
X = 4
Y = 2
Z = 1

RANGE	CODE		
	a	b	c
200Ω	0	0	1
2K	0	1	0
20K	0	1	1
200K	1	0	0
2000K	1	0	1
20MΩ	1	1	0

They are effective only when the Free Run line is held low. Arm Enable is usually generated by the external recording device, and is held low while the device is redording the DOU's output. It returns high to indicate that the recorder is no longer busy. While Arm Enable is high (recorder is not busy) a low-to-high (positive) transition on the Arm Input line will initiate the DOU update sequence. The Arm Input must remain high for at least 375 nanoseconds to be effective. The Arm Input transition will be ignored if Arm Enable is low or if the transition is from high-to-low.

602-16. The Free Run input is independent of, and overrides the effect of, both the Arm Input and the Arm Enable commands. When enabled (high), Free Run allows the DOU output to be automatically updated at the end of each measurement cycle. When Free Run is disabled (low), DOU updating must be controlled by the Arm Enable and Arm Input commands.

602-17. The Busy output is generated whenever the DOU output registers are being updated. Its function is to inhibit the external recorder from recording incorrect data. Therefore, its trailing edge is recommended for use as a print command to the recorder. Busy is available at the DOU output as both Busy and $\overline{\text{Busy}}$.

602-18. POLARITY FLAG

602-19. The polarity of the dc voltage input to the A/D Converter determines which polarity sign will be presented at DOU output pin 3; pin 5 provides $\overline{\text{POL}}$ only. A positive dc level at the converter will cause DOU output pin 3 to go to logic 1 and pin 5 to go to logic 0. A

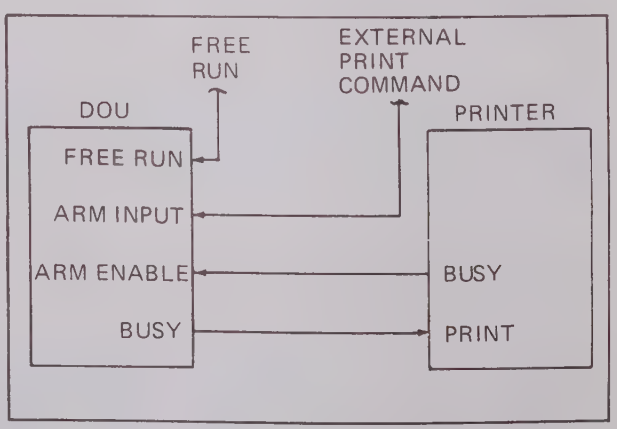


Figure 602-1. Recommended Handshaking Connections

negative converter input will cause the opposite logic level output from each pin.

602-20. OVERLOAD PROTECTION

602-21. The DOU provides a single-bit output indication of a display overload condition. When the digit count exceeds the display capacity, pin-6 of the DOU output connector changes from a low to a high output level.

602-22. RANGE CODE

602-23. The instrument range is presented in a three-bit octal format at DOU output connector pins H, 7, and F. The output code representing each range is presented in Table 602-1.

602-24. DISPLAY DIGITS

602-25. The numeric value of each digit of the instrument display is presented in a four-bit bcd format (W-X-Y-Z) at the DOU output connector. The connector pin assignments for each significant digit of the display are provided in Table 602-1. The most significant digit (DOU connector pins 18, 19, V, and W) needs only one active bit to represent the two display digits, 1 or 0. The three remaining bits are connected to ground on the DOU PCB.

602-26. Theory of Operation

602-27. The 8810A transmits measurement data to the DOU in bcd character-serial format over four data lines designated W, X, Y, and Z. Eight characters are transmitted for a complete measurement update. As each character is transmitted its four bits are sequentially scanned on the DOU by four successive strobe 5 (ST5) signals. The scanned bits are serially transmitted across an isolation circuit and presented as the input to a series of shift registers. The shift register outputs are inverted and buffered to provide character-parallel measurement data at the DOU output connector. Typical DOU timing is shown in Figure 602-2.

602-28. The DOU output can be updated by an external command (Arm Enable, Arm Input) or allowed to update automatically (Free Run) at the end of each new instrument measurement. A logic 1 high applied to Arm Enable (pin B) and logic 0 (low) applied to Free Run will prevent acquisition of new data by the DOU. A positive going trigger applied to Arm Input (pin C) will enable the DOU to acquire data.

602-29. New data will start to load into the DOU after the next measurement is complete. BZ (busy from the instrument to the DOU) occurs in synchronous with the second ST0 signal after a measurement is complete and lasts for one strobe cycle. BZ is presented to U10 as a data input. ST5 clocks the data into U10. At this time the Busy flags are applied to the DOU output signifying that data is being changed. U10 enables the data on W to be serially loaded into the bottom of U4 during the first strobe cycle. When ST5 occurs again, the data in U10 is shifted to enable the data on X to be loaded into U4. Four strobe cycles are required to load the new data. When the

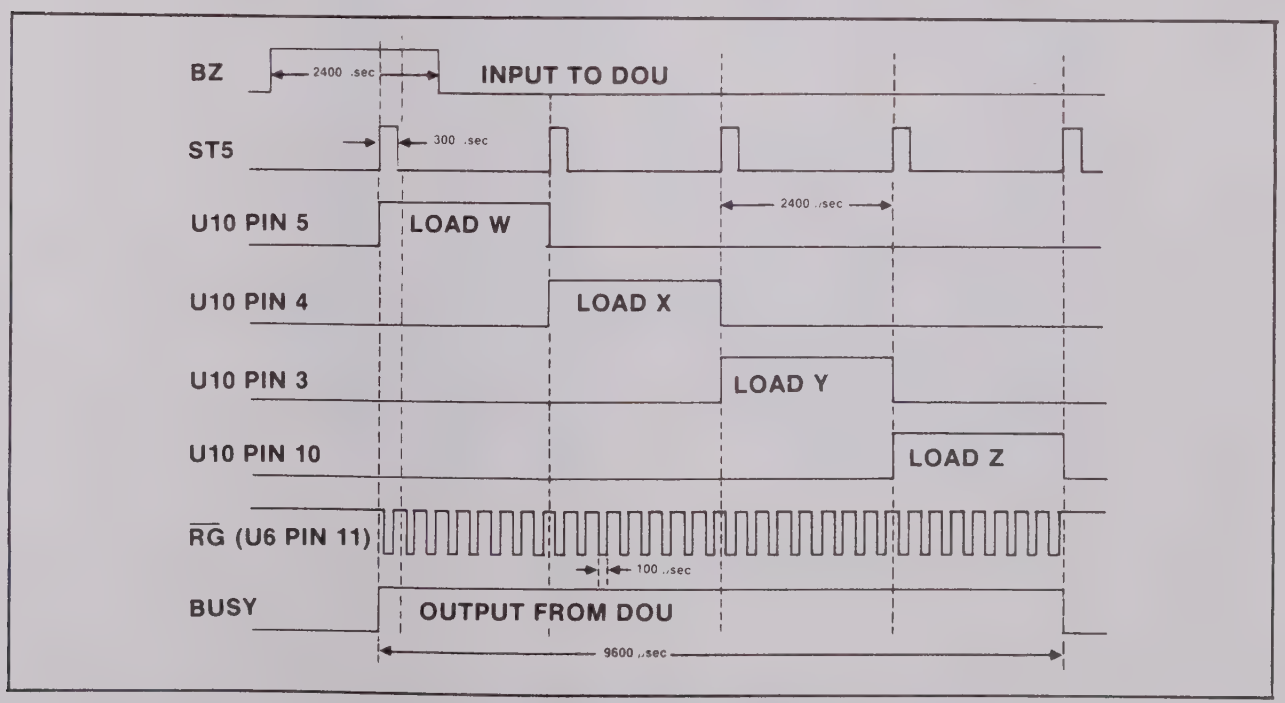


Figure 602-2. DOU Timing Diagram

fifth ST5 signal occurs, U10 is emptied of data and all its outputs are 0. RG is then inhibited by U11 and the clocking of data ceases. The Busy flags are cleared from the DOU output and the data can be read.

602-30. Arm Input may go to 0 at any time in the cycle, but it must go to 0 before a data update can be externally commanded. if desired, the DOU will automatically update at the end of each instrument measurement. If Free Run is allowed to go high, the DOU will automatically update the data after each measurement.

602-31. LIST OF REPLACEABLE PARTS

602-32. A list of replaceable parts for the DOU PCB Assembly is given in Table 602-2. Refer to Section 5 of this manual for ordering information.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 602-2. DOU PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	DOU PCB ASSEMBLY, (8800A-4005) FIGURE 602-3						
C1	CAP, ELECT, 220 UF +50/-10%, 10V	236935	73445	ET221X010A5	2	1	
C2	CAP, PLSTC, 0.022 UF +/-10%, 50V	271577	06001	75F1R5A222	1		
C3	CAP, ELECT, 220 UF +50/-10%, 10V	236935	73445	ET221X010A5	REF		
C4	CAP, FXD, CER, 0.05 UF +80/-10%, 25V	148924	32897	5855Y5U503Z	1		
CR1	RECTIFIER, BRIDGE	296509	51605	FB100	1	1	
CR2	DIODE, ZENER, 5.6V	277236	07910	1N752A	1	1	
MP1	CABLE, FLAT	385922	08261	5112-607.25X	1		
MP2	SOCKET, IC, 14 PIN	276527	23880	TSA2900-14W	4		
MP3	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	11		
Q1	XSTR, SI, NPN	218396	04713	2N3904	3	1	
Q2	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q3	XSTR, SI, PNP	195974	04713	2N3906	2	1	
Q4	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q5	XSTR, SI, NPN	218396	04713	2N3904	REF		
R15	RES, CAR DEP, 1K +/-5%, 1/4W	343426	TOYO	R251025	2		
R16	RES, CAR DEP, 1K +/-5%, 1/4W	343426	TOYO	R251025	REF		
R17	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	2		
R18	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	REF		
RN1	RES, NETWORK	385930	89536	385930	1	1	
T1	XFMR, POWER	374652	89536	374652	1		
U1	⊘IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	5	1	
U2	⊘IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U3	⊘IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U4	⊘IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U5	⊘IC, C-MOS, DUAL, TYPE "D" FLIP-FLOP	340117	04713	MC14013CL	1	1	
U6	⊘IC, COS-MOS, NOR GATES	355172	04713	MC14001CL	1	1	
U7	⊘IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	CD4049AE	6	1	
U8	⊘IC, C-MOS, HEX, BUFFER/INVERTER	381849	49671	DC4049AE	REF		
U9	⊘IC, DTL, C-MOS, QUAD, BILATERAL SW	363838	49671	CD4016AE	1	1	
U10	⊘IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U11	⊘IC, C-MOS, DUAL, 4-INPUT, NOR GATES	363820	49671	CD4002AE	1	1	
U12	⊘IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	DC4049AE	REF		
U13	⊘IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	DC4049AE	REF		
U14	⊘IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	DC4049AE	REF		
U15	⊘IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	DC4049AE	REF		
U16	OP TO ISOLATOR, PHOTO XSTR	380014	86539	MCT2	2	1	
U17	OP TO ISOLATOR, PHOTO XSTR	380014	86539	MCT2	REF		

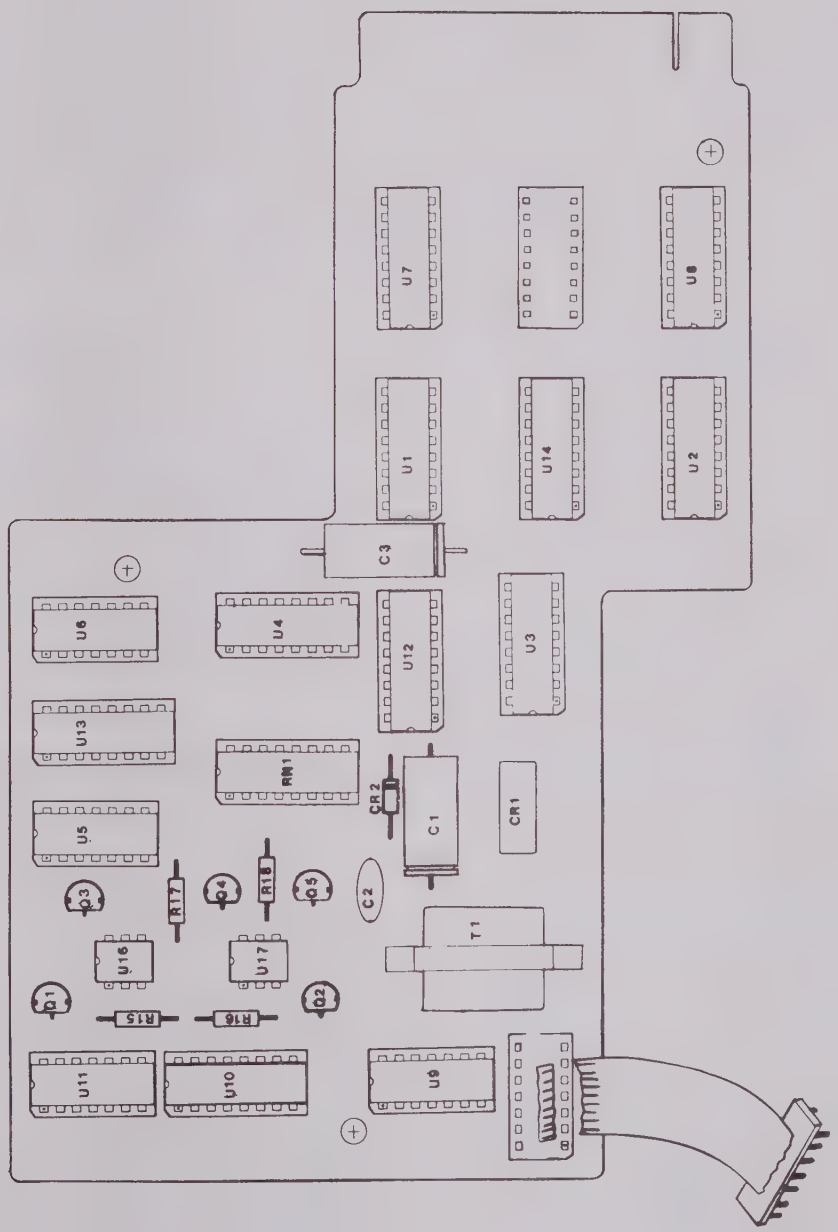


Figure 602-3. DOU PCB Assembly

Option -007
Ohms Converter

607-1. INTRODUCTION

607-2. The Ohms Converter, Option -007, is a field installable pcb assembly designed to extend the measurement capability of the 8810A to include resistance. It contributes six ranges (200Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2000 kΩ, and 20 MΩ), and employs a constant current conversion technique to provide a voltage reading equivalent to the measured resistance. Both two- and four-wire measurements can be made on all ranges. Maximum resolution on the 200 ohm range is 1 milliohm.

607-3. SPECIFICATIONS

607-4. Specifications for the Ohms Converter are given in Section 1 of this manual.

607-5. INSTALLATION

607-6. Use the following procedure to install the Ohms Converter:

1. Remove the 8810A from its case, then remove the top guard cover.

2. Determine the measurement functions that will be available when the Ohms Converter is installed; i.e., DCV and kΩ or DCV, ACV and kΩ. If ACV is not available, prepare and install the Lockout Assembly as shown in Figure 607-1. If the True RMS/AC Converter (Options -009/-008) is installed, the Lockout Assembly is not required. In this case, complete only steps 1, 2, and 3 of Figure 607-1.

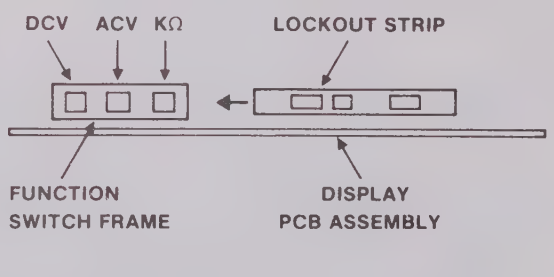
3. Position and install the Ohms Converter PCB Assembly on the Main PCB Assembly as shown in Figure 607-2. The Ohms Converter PCB mates with pins on the Main PCB. Press the pcb into place.

4. Connect the five loose wires on the Ohms Converter PCB to the pins indicated in Figure 607-2.

5. Install the top guard cover on the 8810A and perform the Calibration adjustments procedure given later in this subsection.

607-7. OPERATION

607-8. Once installed the Ohms Converter requires no operator attention. Instructions for making resistance measurements are included in Section 2 of this manual.



1. Straighten both ends of the currently installed Lockout Strip.
2. Release all three FUNCTION switches by positioning the strip so that one of the released switches can be operated, then partially depress the released switch.
3. Remove the Lockout Strip by sliding it sideways under the FUNCTION switch frame.
4. Position and insert the new Lockout Strip as shown above. Adjust the strip so that the DCV and KΩ switches are free to operate, and the ACV switch is locked out.
5. When the Lockout Strip is properly positioned bend both end tabs up to secure its position.

Figure 607-1. Installing the Lockout Strip

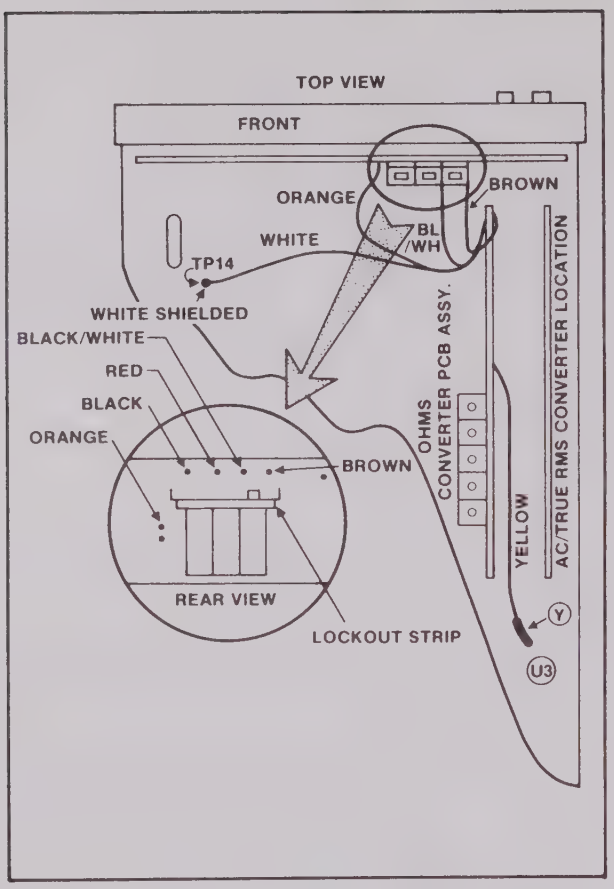


Figure 607-2. Ohms Converter PCB Installation Details

607-9. THEORY OF OPERATION

607-10. The Ohms Converter determines the value of an unknown resistance by comparison. When the same current is applied to a resistance of known value and a resistance of unknown value the voltage level developed across each is directly proportional to the value of each resistance. A comparison of the two voltage levels will indicate the value of the unknown resistance relative to the value of the known resistance. The simplified circuit diagram, in Figure 607-3 shows how the Ohms Converter produces the two voltages to be compared by the A/D Converter.

607-11. The current to be applied to the known and unknown resistance is supplied by a constant current source consisting of a voltage regulator, (Q21 and Q1), and a current regulator, Q2 and CR2). The voltage regulator is designed such that any change in input or output voltages will proportionally change Q2's impedance thus drawing the output voltage back to the desired value. This output voltage controls the bias on Q2's base, and with a constant emitter bias, (supplied by CR2) Q2's collector current will remain very stable over wide variances in supply voltage or load conditions. This current is then applied to the known and unknown values of resistance so that a comparison can be obtained.

607-12. The Ohms Converter employs an overvoltage protection circuit consisting of Q2, Q22, and Q23 that enables it to withstand input transients up to 1 kV dc or peak ac. High voltage applied to the protection circuit is enough to make appreciable reverse current to flow through Q23. This will effectivly connect Q23 and Q22 in series for a total standoff voltage of 700V. If the voltage continues to rise, Q2 will also be connected in the series and the total standoff will then be 1 kV. The current in this case is dissipated by resistors R35, R36, and R37.

CAUTION

It should be noted that the protection scheme used in the Ohms Converter is designed primarily for protection against voltages below 300V dc and ac, but can withstand transients of up to 1 kV.

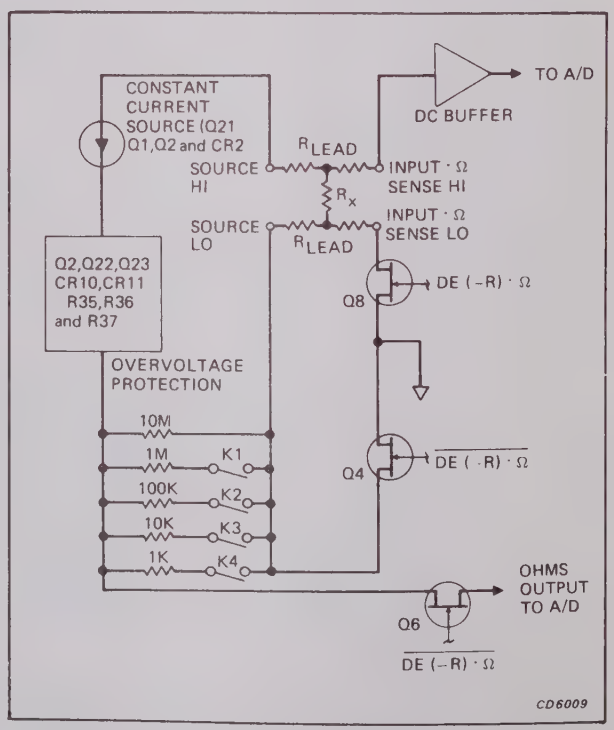


Figure 607-3. Ohms Converter Simplified Circuit Diagram

607-13. During the integrate time period the DE (–R) . Ω control signal closes switch Q8. The positive voltage developed by the current flow across Rx is applied through the INPUT . Ω SENSE HI terminal to the DC Buffer and A/D Controller. At the end of the integrate period Q8 opens and Q4 and Q6 close. The negative voltage developed across the known resistance, termed ohms output, passes through Q6 to the A/D Converter.

607-14. PERFORMANCE TEST

607-15. Using the resistor decade (specified in Table 4-1), apply the resistance values indicated in Table 607-1, to the 8810A input terminals. Select the specified range and observe the 8810A for the proper results.

NOTE

Use four-terminal ohms measurement method.

607-16. CALIBRATION ADJUSTMENTS

607-17. Use the following procedure to calibrate the Ohms Converter. See Section 4 for the list of recommended equipment.

NOTE

Remove the shorting links that connect the two HI terminals together and the two LO terminals together. Use the four-terminal measurement technique for this procedure.

1. Select the kΩ function.
2. Connect a 10 MΩ standard resistance (ESI 1063B resistor decade) to the INPUT terminals.
3. Select the 20 MΩ range.
4. Adjust the 10 MΩ cal (R5) for an 8810A display of 10.0000 ±3 digits.
5. Apply a 100 kΩ standard resistance to the input. The display should indicate 0.1000 ±1 digit.
6. Apply a 1 MΩ standard resistance to the input. The display should indicate 1.0000 ±4 digits.
7. Select the 2000 kΩ range and adjust the 1 MΩ cal (R6) for an 8810A display of 1000.00 ±1 digit.

Table 607-1. Resistance Checks

RANGE	INPUT	DISPLAY LIMITS	LED ANNUNCIATOR
20MΩ	10MΩ	9.9797 – 10.0203	20MΩ
2000KΩ	1000KΩ (1MΩ)	999.47 – 1000.53	
200KΩ	100KΩ	99.987 – 100.013	
20KΩ	10KΩ	9.9987 – 10.0013	
2KΩ	1KΩ	.99987 – 1.00013	
200Ω	100Ω	99.970 – 100.030	200Ω
200Ω	10Ω	09.988 – 010.012	200Ω
AUTO	10Ω	09.988 – 010.012	200Ω
AUTO	100Ω	99.970 – 100.030	200Ω
AUTO	1KΩ	.99987 – 1.00013	
AUTO	10KΩ	9.9987 – 10.0013	
AUTO	100KΩ	99.9987 – 100.013	
AUTO	1000KΩ (1MΩ)	999.47 – 1000.53	
AUTO	10MΩ	9.9797 – 10.0203	20MΩ

8. Apply a 100 kΩ standard resistance to the input. The display should indicate 100.00 ±1 digit.
9. Select the 200 kΩ range.
10. Adjust the 100 kΩ cal (R8) for an 8810A display of 100.000 ± 1 digit.
11. Apply a 10 kΩ standard resistance to the input. The display should indicate 10.000 ±1 digit.
12. Select the 20 kΩ range.
13. Adjust the 10 kΩ cal (R10) for an 8810A display of 10.000 ±1 digit.
14. Apply a 1 kΩ standard resistance to the input. The display should be 1.0000 ±1 digit.
15. Select the 2 kΩ range.
16. Adjust the 1 kΩ cal (R13) for an 8810A display of 1.00000 ±1 digit.
17. Apply a 100Ω standard resistance to the input. The display should be .10000 ±1 digit.
18. Select the 200Ω range.
19. Verify that the 8810A display is 100.000 ±6 digits.
20. Select the AUTO pushbutton. The unit should remain in the 200Ω range.
21. Remove the 100Ω input resistor. The unit should step to the 20 MΩ range.

22. Connect the shorting links for two-terminal operation.

607-18. LIST OF REPLACEABLE PARTS

607-19. A list of replaceable parts for the Ohms Converter PCB Assembly is given in Table 607-2. Refer to Section 4 of this manual for ordering information.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 607-2. Ohms Converter PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	OHMS CONVERTER PCB ASSY (8800A-4010T) FIGURE 607-4						
C1	CAP, POLYSTYRENE, 0.022 UF +/-10%, 100V	333823	01281	863UW22391	1		
C5	CAP, TA, 100 PF +/-10%, 1 KV	105593	71590	DD101	1		
C6	CAP, TA, 10 UF +/- 20%, 15V	193623	56289	196D106X-0015KA1	1		
C8	CAP, MICA, 33 PF +/-5%, 500V	160317	72136	DM15E330J	1		
C9	CAP, MICA, 10 PF +/-5%, 500V	105536	72136	DM15C100J	1		
C10	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	1		
C11	CAP, TA, 4.7 UF +/-20%, 25V	161943	56289	196D475X-0025KA1	1		
C12	CAP, TA, 0.22 UF +/-20%, 35V	161331	56289	196D224X-0035HA1	1		
C13	CAP, CER, 0.05 UF +/-20%, 100V	149161	56289	55C23A1	1		
CR2	DIODE, LIGHT EMITTING, RED	385898	12040	59NSL-5046	1	1	
CR4	DIODE, SI	348177	07263	FD7223	5	1	
CR5	DIODE, SI	348177	07263	FD7223	REF		
CR8	DIODE, SI	348177	07263	FD7223	REF		
CR9	DIODE, SI	348177	07263	FD7223	REF		
CR10	DIODE, SI	453399	01295	1N4007	3	1	
CR11	DIODE, SI	453399	01295	1N4007	REF		
CR12	DIODE, SI	453399	01295	1N4007	REF		
CR13	DIODE, SI	348177	07263	FD7223	REF		
J4	CONNECTOR, FEMALE						
	PIN, SMALL	375329	00779	85863-3	8		
	PIN, LARGE	170480	74970	105-752	3		
K1	RELAY, DRY REED, SPST	357582	71707	UF-40070	4		
K2	RELAY, DRY REED, SPST	357582	71707	UF-40070	REF		
K3	RELAY, DRY REED, SPST	357582	71707	UF-40070	REF		
K4	RELAY, DRY REED, SPST	357582	71707	UF-40070	REF		
L1	CHOKE, RF, 4.7 UH	174722	72259	WEE-417	1		
Q1	XSTR, SI, PNP	225599	12040	PN4250	2	1	
Q2	XSTR, SI, NPN	370684	04713	MPSA42	3	1	
Q3	XSTR, SI, NPN	168716	12040	ST07154	3		
Q4	XSTR, SI, NPN	261578	89536	261578	2	1	
Q5	XSTR, SI, NPN	218396	04713	2N3904	4	1	
Q6	XSTR, FET, N-CHANNEL	343830	89536	343830	1	1	
Q7	XSTR, SI, NPN	168716	12040	ST07154	REF		
Q8	XSTR, SI, NPN	261578	89536	261578	REF		
Q9	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q17	XSTR, SI, NPN	168716	12040	ST07154	REF		
Q21	XSTR, SI, PNP	225599	12040	PN4250	REF		
Q22	XSTR, SI, NPN	370684	04713	MPSA42	REF		
Q23	XSTR, SI, NPN	370684	04713	MPSA42	REF		
Q24	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q25	XSTR, SI, NPN	218396	04713	2N3904	REF		
R1	RES, DEP CAR, 22K +/-5%, 1/4W	348870	80031	CR251-4-5P22KT	2		
R3	RES, DEP CAR, 750 +/-5%, 1/4W	441659	80031	CR251-4-5P750ET	1		
R5	RES, VAR, CERMET, 50K +/-10%, 1/2W	288290	89536	288290	1	1	
R6	RES, VAR, CERMET, 2K +/-10%, 1/2W	403428	11236	362S201A	1	1	
R8	RES, VAR, 100 +/-10%, 1/2W	326116	11236	362S101A	1	1	
R10	RES, VAR, 100K +/-10%, 1/2W	288308	89536	288308	1	1	
R11	RES, MF, 1M +/-1%, 1/8W	268797	91637	MFF1-81004F	1		
R12	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30KT	5		
R13	RES, VAR, 10K +/-10%, 1/2W	285171	89536	285171	1	1	

Table 607-2. Ohms Converter PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R14	RES, MF, 95.3K +/-1%, 1/8W	289561	91637	MFF1-81002F	1		
R16	RES, DEP CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P-1MT	3		
R17	RES, DEP CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P-1MT	REF		
R18	RES, DEP CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P-1MT	REF		
R19	RES, DEP CAR 150K +/-5%, 1/4W	348938	80031	CR251-4-5P-150KT	1		
R20	RES, DEP CAR 330K +/-5%, 1/4W	376640	80031	CR251-4-5P-330KT	1		
R25	RES, DEP CAR, 120K +/-5%, 1/4W	441386	80031	CR251-4-5P-120KT	1		
R26	RES, COMP, 470K +/-5%, 2W	147710	01121	HB4745	1		
R27	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P-100KT	1		
R29	RES, DEP CAR, 22K +/-5%, 1/4W	348870	80031	CR251-4-5P22KT	REF		
R31	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10KT	4		
R32	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10KT	REF		
R33	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10KT	REF		
R34	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10KT	REF		
R35	RES, COMP, 390K +/-5%, 1/2W	222190	01121	EB3945	2		
R36	RES, COMP, 390K +/-5%, 1W	453472	01121	GB3945	1		
R37	RES, COMP, 390K +/-5%, 1/2W	222190	01121	EB3945	REF		
R38	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30KT	REF		
R39	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30KT	REF		
R40	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30KT	REF		
R41	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30KT	REF		
R42	RES, DEP CAR, 120 +/-5%, 1/4W	442293	80031	CR251-4-5P-120ET	1		
R43	RES, DEP CAR, 220 +/-5%, 1/4W	342626	80031	CR251-4-5P-220ET	2		
R44	RES, DEP CAR, 220 +/-5%, 1/4W	342626	80031	CR251-4-5P-220ET	REF		
RN6	RESISTOR NETWORK	363796	01121	FN274	1	1	
T1	XFMR	457168	89536	457168	1		
W3	WIRE ASSY, SHIELDED	457077	89536	457077	1		
W4	WIRE ASSY, BRN	373738	89536	373738	1		
W5	WIRE ASSY, YEL	457069	89536	457069	1		
W6	WIRE ASSY, BLK/WHT	378281	89536	378281	1		
W7	WIRE ASSY, ORN	457051	89536	457051	1		

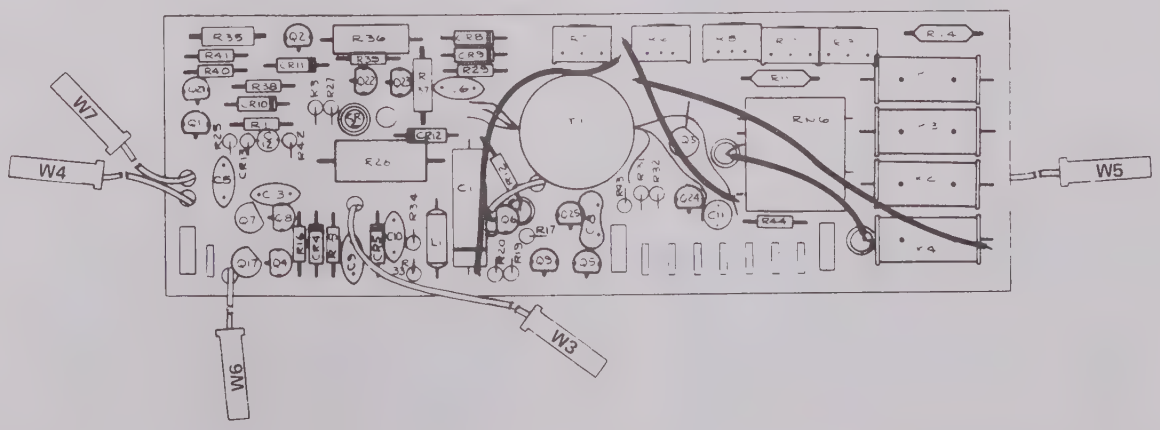


Figure 607-4. Ohms Converter PCB Assembly

Option -008
AC Converter

608-1. INTRODUCTION

608-2. The AC Converter, Option -008, is a field installable pcb assembly designed to extend the measurement capability of the 8810A to include ac voltages. it contributes four ranges (2, 20, 200, and 750V ac) and employs average ac conversion techniques to provide an rms indication with a maximum sensitivity of 10 μV. Circuit loading is minimized by a 2 MΩ input resistance shunted by less than 100 pF. Response time is 1.5 seconds to achieve rated accuracy of the selected range.

608-3. SPECIFICATIONS

608-4. Specifications for the AC Converter are presented in Section 1 of this manual.

608-5. INSTALLATION

608-6. Use the following procedure to install the AC Converter:

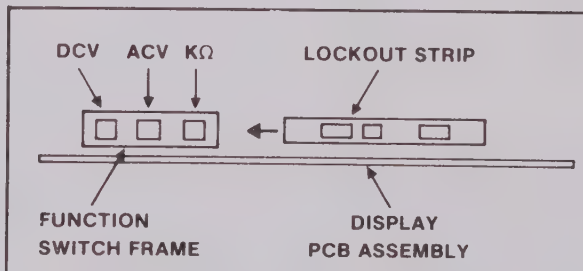
1. Remove the 8810A from its case, then remove the top guard cover.

2. Determine the measurement functions that will be available when the AC Converter is installed, i.e., DCV and ACV or DCV, ACV, and kΩ. If kΩ is not available, prepare and install the Lockout Assembly as shown in Figure 608-1. If the Ohms Converter (Option -007) is installed, the Lockout Assembly is not required. In this case, complete only steps 1, 2, and 3 of Figure 608-1.

3. Position and install the AC Converter PCB Assembly on the Main PCB Assembly as shown in Figure 608-2. The AC Converter PCB mates with pins provided on the Main PCB. Press the pcb into place.

4. Connect the red/white wire on the AC Converter PCB to the pin marked RD/W (See Figure 608-2) on the rear of the Display PCB Assembly.

5. Install the top guard cover on the 8810A and perform the Calibration Adjustments procedure given later in this subsection.



1. Straighten both ends of the currently installed Lockout Strip.
2. Release all three FUNCTION switches by positioning the strip so that one of the released switches can be operated, then partially depress the released switch.
3. Remove the Lockout Strip by sliding it sideways under the FUNCTION switch frame.
4. Position and insert the new Lockout Strip as shown above. Adjust the strip so that the DCV and ACV switches are free to operate, and the KΩ switch is locked out.
5. When the Lockout Strip is properly positioned bend both end tabs up to secure its position.

Figure 608-1. Lockout Strip Installation Instructions

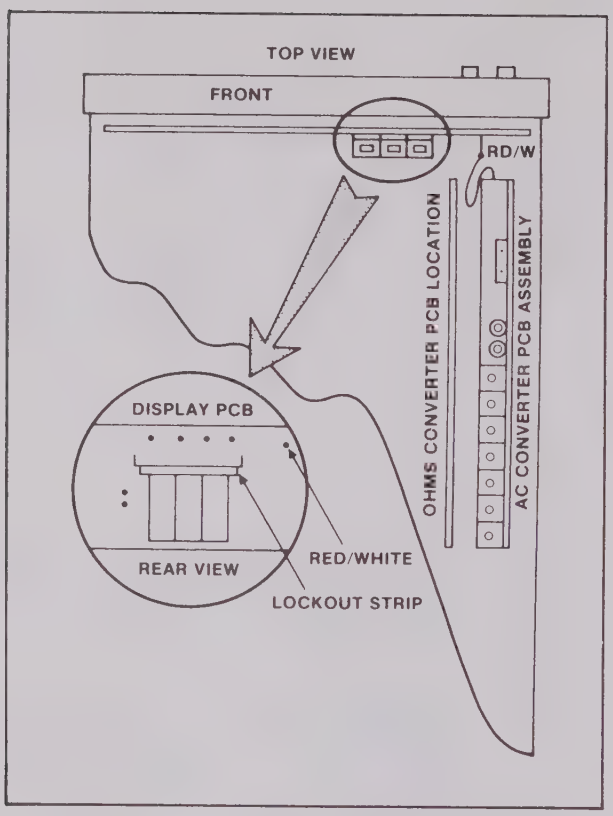


Figure 608-2. AC Converter PCB Installation Details

608-7. OPERATION

608-8. Once installed the AC Converter requires no operator attention. Instructions for making ac voltage measurements are included in Section 2 of this manual.

608-9. THEORY OF OPERATION

608-10. The AC Converter produces a dc output voltage proportional to the ac input voltage. The simplified circuit diagram of the AC Converter, presented in Figure 608-3, should be referred to when reading the following description of the circuit operation.

608-11. The ac voltage input is capacitively coupled across C1 through input Resistor R1 to the inverting input of amplifier Q1, U1. The gain of the amplifier is determined by the ratio of the feed-back resistance, as selected by range relay K6, K7, and K8, to the input resistor R1. The amount of alternating current at the junction point of CR4 and CR5 is therefore proportional to the level of the ac voltage input. One-half of the alternating current passes through CR5 to develop a dc voltage level at the input of the Low Pass (L.P.) Filter. The L.P. Filter then filters the ac signal superimposed on the dc voltage to produce a dc output voltage directly proportional to the ac voltage input.

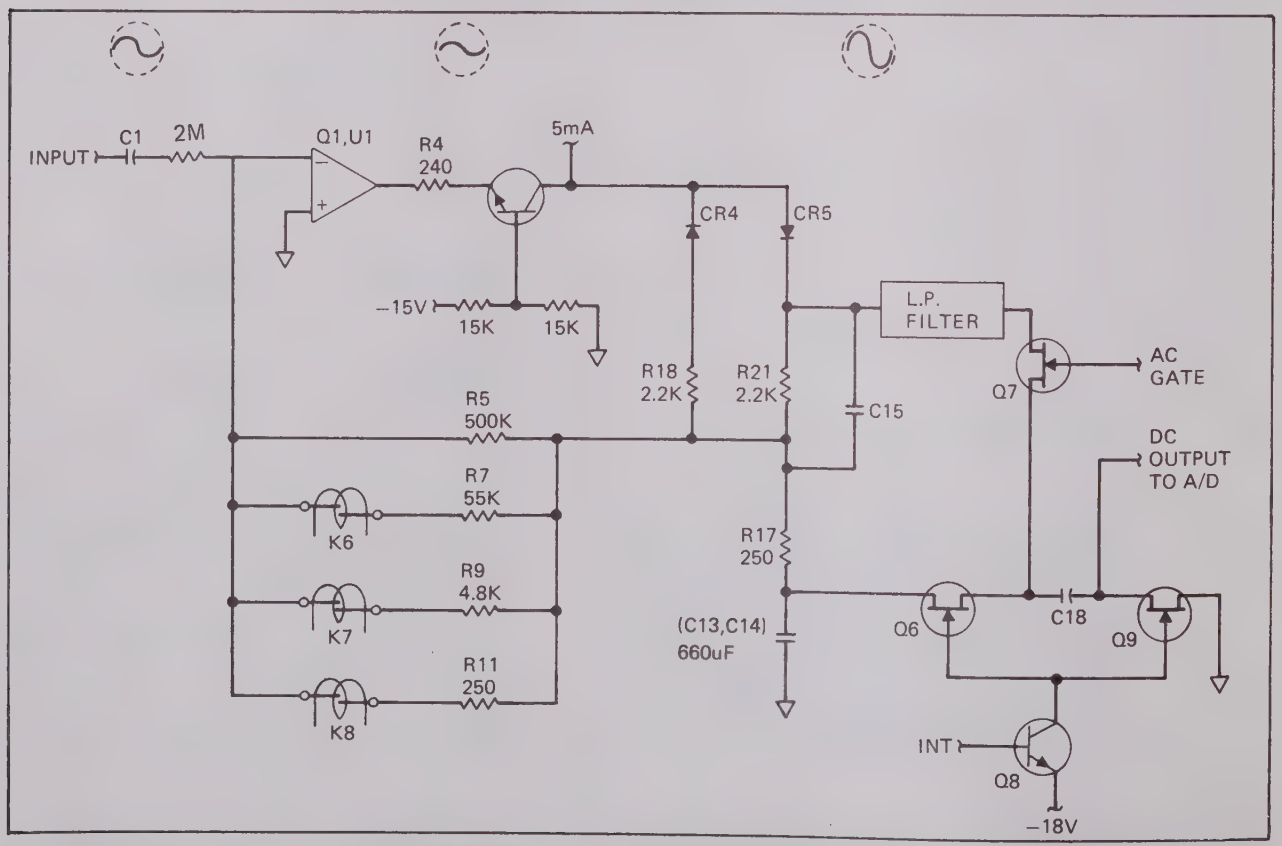


Figure 608-3. AC Converter Simplified Circuit Diagram

608-12. The AC Converter circuitry creates an offset voltage that, if not compensated for, would create an error in the displayed value of the ac input voltage. The offset voltage, sensed at the junction point of R17, C13, and C14, is applied to C18 when FET switches Q6 and Q9 are turned on; these switches are turned off by an integrate (INT) signal applied to Q8. When the AC GATE command (coincidental with the INT command) turns on Q7, the dc output voltage of the L.P. Filter will be reduced by the value of the feed-back voltage stored in C18. The dc voltage output to the A/D Converter is therefore representative of the level of ac input voltage.

608-13. PERFORMANCE TEST

608-14. Sequentially select the ac voltage ranges shown in Table 608-1 and apply the indicated voltage/frequency for each range setting (use the ac calibrator specified in Table 4-1). The 8810A display should read within the limits shown. Complete the calibration adjustments procedure if the AC Converter fails any part of this test. Otherwise the calibration adjustments will not be required.

Table 608-1. AC Voltage Checks

VAC RANGE	AC INPUT VOLTAGE	FREQUENCY IN Hz	DISPLAY LIMITS
2 VAC	1.00000	400 Hz	.99890 – 1.00110
2 VAC	1.0000	100 kHz	.98940 – 1.01060
20 VAC	10.0000	400 Hz	9.9890 – 10.0110
20 VAC	10.0000	100 kHz	9.8940 – 10.1060
200 VAC	50.000	400 Hz	49.940 – 50.060
200 VAC	50.000	100 kHz	49.440 – 50.560
750 VAC	100.000	400 Hz	99.830 – 100.170
750 VAC	100.000	20 kHz	99.710 – 100.290
AUTO	.10000	10 kHz	.09955 – .10045
AUTO	1.00000	10 kHz	.99730 – 1.00270
AUTO	10.0000	10 kHz	.99730 – 1.00270
AUTO	100.000	10 kHz	.99730 – 1.00270
AUTO	750.00	10 kHz	997.75 – 1002.25

608-15. CALIBRATION ADJUSTMENTS

608-16. The following procedure is used to adjust the accuracy of each of the ac voltage ranges. All adjustments are made with the AC Converter's shield in place and the 8810A's top guard in place. Adjustment names given in this procedure agree with those silk-screened onto the top guard cover. The reference designator for each adjustment is given in parenthesis.

608-17. Sequentially select the ac voltage ranges shown in Table 608-2 and use an ac calibrator to apply the indicated voltage/frequency for each range setting. As each input signal is applied, adjust the specified adjustment for an 8810A display reading within the limits shown.

608-18. LIST OF REPLACEABLE PARTS

608-19. A list of replaceable parts for the AC Converter PCB Assembly is given in Table 608-3. Refer to Section 5 of this manual for ordering information.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 608-2. AC Voltage Range Adjustments

VAC RANGE	AC INPUT VOLTAGE (RMS)	FREQUENCY IN Hz	ADJUSTMENT	DISPLAY LIMITS
750	500	500	500V/500 Hz (R20)	499.97 to 500.03
750	500	10k	100V/50 kHz (C2)	499.97 to 500.03
2	1.0	500	1.0V/500 Hz (R6)	.99995 to 1.00005
2	1.0	50k	1.0V/50 kHz (C7)	.99980 to 1.00020
750	500	10k	100V/50 kHz (C2)	499.50 to 500.50
2	1.0	50k	1.0V/50 kHz (C7)	.99950 to 1.00050
200	100	500	100V/500 Hz (R10)	99.995 to 100.005
200	100	50k	500V/10 kHz(C23)	99.950 to 100.050
20	10	500	10V/500 Hz (R8)	9.9995 to 10.0005
20	10	50k	10V/50 kHz (C9)	9.9950 to 10.0050

Table 608-3. AC Converter PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	AC CONVERTER PCB ASSY, (8800A-4014) FIGURE 608-3						
C1	CAP, CER, 50,000 PF +/-GMV, 1 KV	423004	56289	7S-12595A	1		
C2	CAP,VAR,TEFLON,TRIMMER,0.25-1.5 PF,100V	273151	72982	530-001	2		
C3	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	2		
C4	CAP, CER, 15 PF +/-2%, 100V	369074	72982	8111-A100-C0G-150G			
C5	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C6	CAP, CER, 2.2. PF +/-0.25 PF, 100V	362731	72982	8101-A100-C0G-229G	1		
C7	CAP,VAR,TEFLON,TRIMMER,0.25-1.5 PF,100V	273151	72982	530-001	REF		
C8	CAP, CER, 27 PF +/-2%, 100V	362749	72982	8121-A100-C0G-270G	1		
C9	CAP, VAR, CER, 1.7-10 PF, 250V	375238	52769	GKC10000	1		
C10	CAP, MICA, 390 PF +/-1%, 500V	355339	72136	DM15D391F	1		
C11	CAP, POLYSTYRENE, 9100 PF +/-2.5%, 160V	355321	71590	2DRP00J-912GAA	1		
C12	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X-0015KA1	1		
C13	CAP, TA, 220 UF +/-20%, 6V	408682	56289	196D227X-0006TE4	3		
C14	CAP, TA, 220 UF +/-20%, 6V	408682	56289	196D227X-0006TE4	REF		
C15	CAP, TA, 5.6 UF +/-20%, 25V	368969	56289	196D565X-0025KA1	1		
C16	CAP, PLYESTER,FILM, 0.47 UF +/-10%, 100V	369124	73445	C280MAH/A470K	2		
C17	CAP, PLYESTER,FILM, 0.47 UF +/-10%, 100V	369124	73445	C280MAH/A470K	REF		
C18	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D396X-0006V	1		
C19	CAP, CER, 180 PF +/-10%, 500V	105890	56289	BB60181KS3N	1		
C20	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F-103M	3		
C21	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F-103M	REF		
C22	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F-103M	REF		
C23	CAP, VAR, CER, 5-50 PF, 250V	404301	52769	GKC50000	1		
C26	CAP, TA, 220 UF +/-20%, 6V	408682	56289	196D227X-0006TE4	REF		
CR1	DIODE, SI	375907	07263	FD7222	5	1	
CR2	DIODE, SI	375907	07263	FD7222	REF		
CR3	DIODE, SI	375907	07263	FD7222	REF		
CR4	DIODE, SI	375907	07263	FD7222	REF		
CR5	DIODE, SI	375907	07263	FD7222	REF		
CR6	DIODE, FET, CURRENT REG	334714	07910	TCR5315	1	1	
K6	RELAY, REED, SPST	357566	71707	UF40069	3		
K7	RELAY, REED, SPST	357566	71707	UF40069	REF		
K8	RELAY, REED, SPST	357566	71707	UF40069	REF		
MP1	CONN, PLUG/JACK, RED	170480	74970	105-752	2		
MP2	CONN, RECEPTACLE, BD-MOD2	375329	00779	85863-3	8		
MP3	HEATSINK, XSTR	370155	05820	204-CB	1		
MP4	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	3		
MP5	SHIELD	406280	89536	406280	1		
MP6	SPACER, XSTR MTG	175125	07047	10172-DAP	1		
MP7	SPACER, PCB, WATER SOLUBLE (USE WITH R1)	334797	32559	T0-35-15	1		
MP8	SPACER,PCB,WATER SOLUBLE (USE W/ C2,C7)	380790	32559	T0-21-10	2		
Q1	XSTR, DUAL FET	379321	89536	379321	1	1	
Q2	XSTR, SI, NPN	218396	04713	2N3904	2	1	
Q4	XSTR, SI, PNP, SELECTED	352146	89536	352146	1	1	
Q5	XSTR, SI, NPN	330803	04713	MPS6560	1	1	
Q6	XSTR, FET, N-CHANNEL	343830	89536	343830	3	1	
Q7	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q8	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q9	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
R1	RES, MF, 2M +/-0.5%, 1W (RED COATING)	354894	89536	354894	1		
R2	RES, MF, 71.5K +/-1%, 1/8W	291435	91637	MFF1-87152F	1		
R3	RES, MF, 158K +/-1%, 1/8W	237214	91637	MFF1-81583F	1		
R4	RES, DEP CAR, 240 +/-5%, 1/4W	376624	80031	CR251-4-5P-240ET	1		
R5	RES, MF, 498.89K +/-0.1%,1/4W	357632	89532	357632	1		
R6	RES, VAR, CERMET, 2K +/-10%, 1/2W	285163	89536	285163	1	1	

Table 608-3. AC Converter PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R7	RES, MF, 55.151 +/-0.1%, 1/8W	357624	89536	357624	1		
R8	RES, VAR, CERMET, 200 +/-10%, 1/2W	285148	89536	285148	1	1	
R9	RES, MF, 4787.4 +/-0.1%, 1/8W	357616	89536	357616	1		
R10	RES, VAR, CERMET, 20 +/-20%, 1/2W	285114	11236	360TS200B	1	1	
R11	RES, MF, 250 +/-0.1%, 1/8W	357608	91637	MFF1-82510B	2		
R12	RES, DEP CAR, 1 +/-5%, 1/4W	357665	80031	CR251-4-5P-1ET	1		
R13	RES, MF, 9.09K +/-1%, 1/8W	221663	91637	MFF1-89091F	1		
R14	RES, MF, 33.2K +/-1%, 1/8W	291393	91637	MFF1-83322F	1		
R15	RES, DEP CAR, 220 +/-5%, 1/4W	342626	80031	CR251-4-5P-220ET	1		
R17	RES, MF, 250 +/-0.1%, 1/8W	357608	91637	MFF1-82510B	REF		
R18	RES, DEP CAR, 3.3K +/-5%, 1/4W	348813	80031	CR251-4-5P-3K3T	1		
R19	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10KT	1		
R20	RES, VAR, CERMET, 50 +/-10%, 1/2W	285122	89536	285122	1	1	
R21	RES, MF, 2194 +/-0.1%, 1/8W	375345	89536	375345	1		
R22	RES, MF, 68.1K +/-1%, 1/8W	236828	91637	MFF1-86812F	1		
R23	RES, DEP CAR, 150K +/-5%, 1/4W	348938	80031	CR251-4-5P-100KT	1		
R24	RES, DEP CAR, 220K +/-5%, 1/4W	348953	80031	CR251-4-5P-220KT	1		
R25	RES, DEP CAR, 47K +/-5%, 1/4W	348896	80031	CR251-4-5P-47KT	1		
R26	RES, DEP CAR, 22 +/-5%, 1/4W	381145	80031	CR251-4-5P-22ET	1		
R27	RES, DEP CAR, 75K +/-5%, 1/4W	394130	80031	CR251-4-5P-75KT	1		
R28	RES, DEP CAR, 12K +/-5%, 1/4W	348847	80031	CR251-4-5P-12KT	1		
R29	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	1		
R30	RES, VAR, CERMET, 1K +/-10%, 1/2W	275750	89536	275750	1	1	
R31	RES, MF, 40.7K +/-1%, 1/8W	267385	91637	MFF1-84872F	1		
U1	IC, OP AMP	329912	12040	LM318H	1	1	
W8	WIRE ASSEMBLY	373688	89536	373688	1		

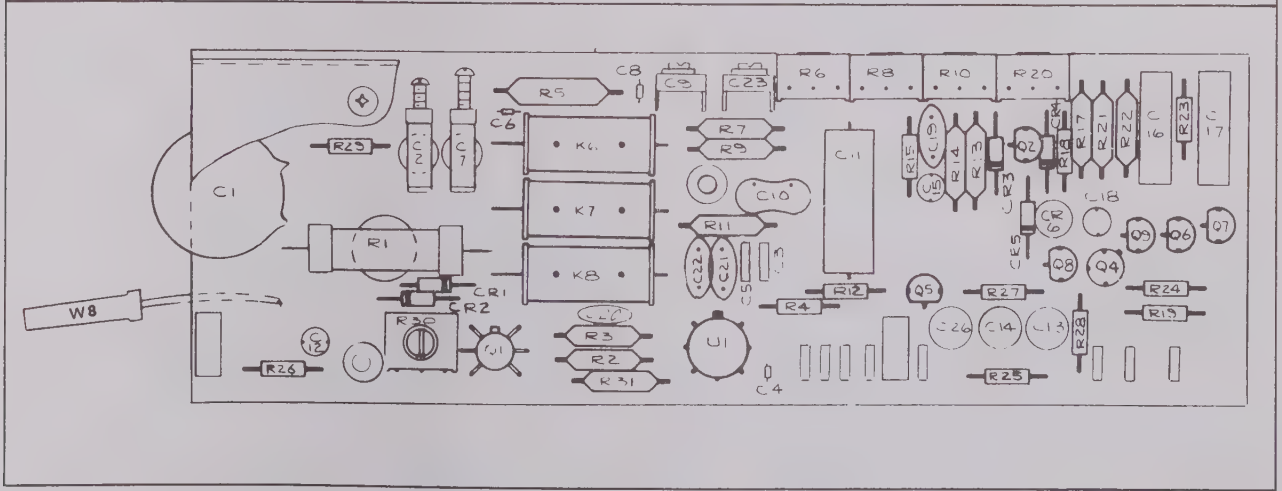


Figure 608-3. AC Converter PCB Assembly

Option -009
True RMS Converter

609-1. INTRODUCTION

609-2. The True RMS Converter, Option -009, is a field installable pcb assembly designed to extend the measurement capability of the 8810A to include true rms voltage measurements. It contributes four ac voltage ranges (2, 20, 200, and 750V ac) and employs a true rms conversion technique to provide true rms measurements with a maximum sensitivity of 10 μV. Circuit loading is minimized by a 1 MΩ input resistance shunted by 100 pF. Response time is 1.5 seconds to achieve rated accuracy of the selected range. Crest factor is 3.

609-3. SPECIFICATIONS

609-4. Specifications for the True RMS Converter are given in Section 1 of this manual.

609-5. INSTALLATION

609-6. Use the following procedure to install the True RMS Converter:

1. Remove the 8810A from its case; then remove the top guard cover.

2. Determine the measurement functions that will be available when the True RMS Converter is installed; i.e., DCV and ACV or DCV, ACV, and kΩ. If kΩ is not available, prepare and install the Lockout Assembly as shown in Figure 609-1. If the Ohms Converter (Option -007) is installed, the Lockout Assembly is not required. In this case, complete only steps 1, 2, and 3 of Figure 609-1.

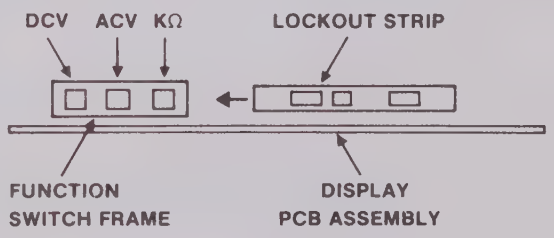
3. Position and install the True RMS Converter PCB Assembly on the Main PCB Assembly as shown in Figure 609-2. The True RMS Converter mates with pins provided on the Main PCB. Press the pcb into place.

4. Connect the red/white wire on the True RMS Converter PCB to the pin marked RD/W (See Figure 609-2) on the rear of the Display PCB Assembly.

5. Install the new top-guard cover on the 8810A and perform the Range Adjustments portion of the Calibration Adjustments procedure.

609-7. OPERATION

609-8. Once installed the True RMS Converter requires no operator attention. Instructions for making ac voltage measurements are included in Section 2 of this manual.



1. Straighten both ends of the currently installed Lockout Strip.
2. Release all three FUNCTION switches by positioning the strip so that one of the released switches can be operated, then partially depress the released switch.
3. Remove the Lockout Strip by sliding it sideways under the FUNCTION switch frame.
4. Position and insert the new Lockout Strip as shown above. Adjust the strip so that the DCV and ACV switches are free to operate, and the KΩ switch is locked out.
5. When the Lockout Strip is properly positioned bend both end tabs up to secure its position.

Figure 609-1. Installing the Lockout Strip

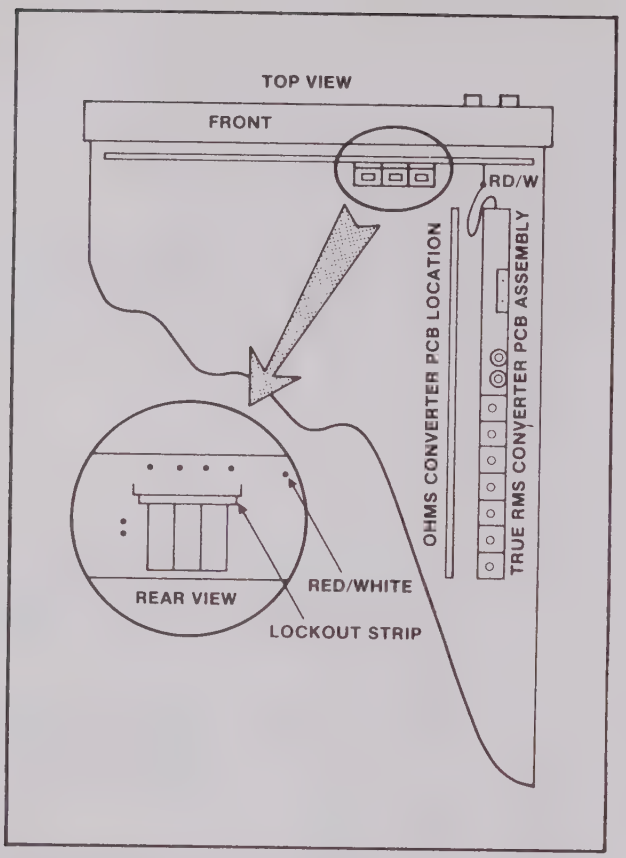


Figure 609-2. True RMS Converter PCB Installation Details

609-9. THEORY OF OPERATION

609-10. The True RMS Converter operates as the 8810A input signal conditioner when the ACV measurement function is selected. Its function is to accept ac input signals, scale them to the selected range, and convert them to a dc level proportional to the true rms value of the input signal. The conversion is mathematically obtained by electroncially squaring and averaging the value of the ac input signal, then taking the square root of that value ($Vrms = \sqrt{Vin^2}$). The resultant dc level is used as the input to the A/D Converter.

609-11. Operation of the True RMS Converter can be divided into five functional groups as shown in Figure 609-3. They include a range amplifier, an absolute value amplifier, a squaring amplifier, a square root amplifier, and an integrator amplifier. The input signal is introduced at the range amplifier where it is scaled to the selected range and buffered. It is then passed on to the absolute value amplifier. This amplifier operates as a full wave rectifier. It converts the ac input voltage into an equivalent positive dc current. The squaring amplifier converts the current into a voltage equal to two times the log of the input, and thus effectively squares the signal. At the square root amplifier the logarithmic voltage is divided in half and converted back into a current. The process effectively takes the square root of the squared input signal and presents it to the input of the integrator amplifier. A current-to-voltage network filters this

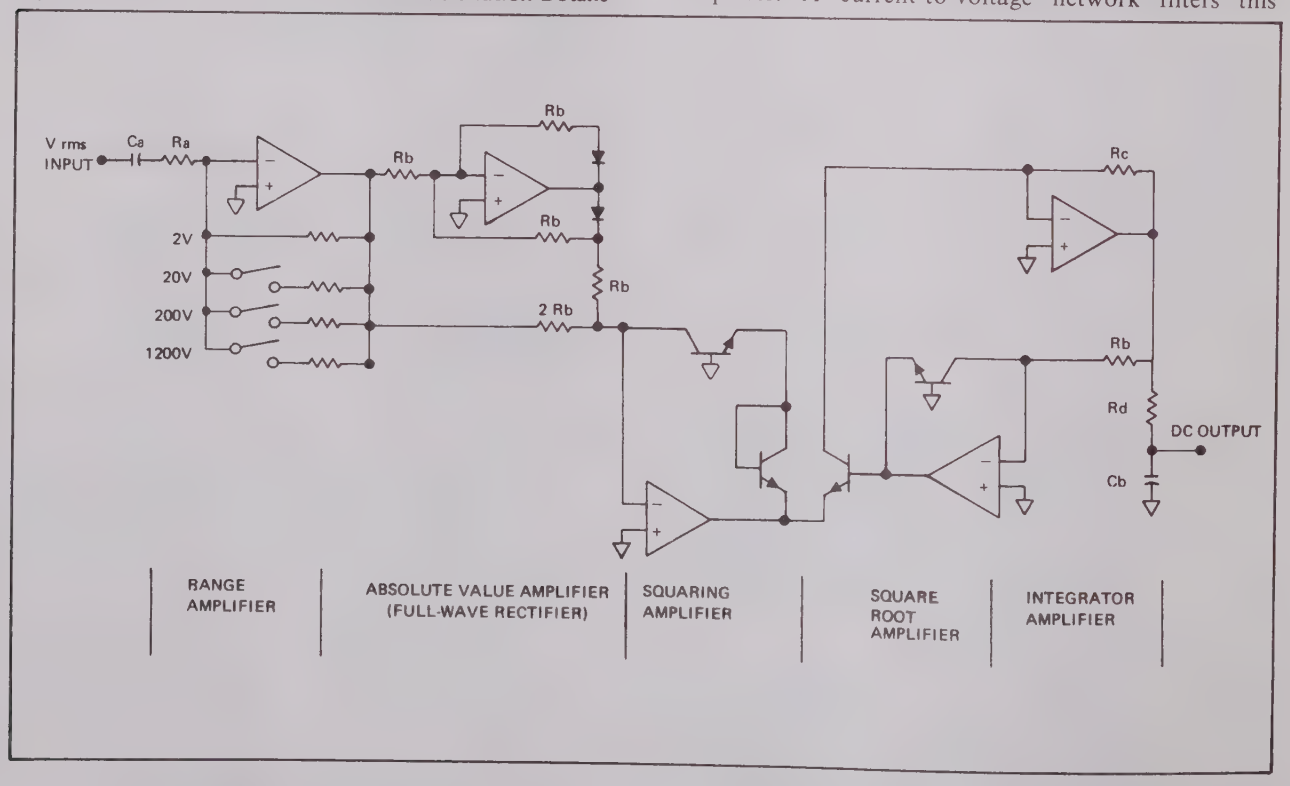


Figure 609-3. True RMS Converter Simplified Circuit Diagram

voltage and presents it as the dc output of the True RMS Converter. This dc level is proportional to the true rms value of the ac intput signal and is used as a direct input to the 8810A's A/D Converter.

609-12. PERFORMANCE TEST

609-13. Sequentially select the ac voltage ranges shown in Table 609-1 and apply the indicated voltage/frequency for reach range setting (use the ac calibrator specified in Table 4-1). The 8810A display should read within the limits shown. Complete the calibration adjustments procedure if the True RMS Converter fails any part of this test. Otherwise the calibration adjustment will not be required.

609-14. CALIBRATION ADJUSTMENTS

609-15. Calibration adjustments for the True RMS Converter are divided into two procedures; Amplifier Bias and Offset Adjustments, and Range Adjustments. The bias and offset adjustment procedure is devoted to zeroing the linear components on the True RMS Converter. The range adjustment procedure ensures the ac measurement accuracy of each available range. Required equipment is listed earlier in Section 4, Table 4-1.

NOTE

These procedures assume that the basic 8810A has met the performance test requirements given in Section 4 of this manual.

609-16. Amplifier Bias and Offset Adjustments

609-17. The following procedure is used to initially zero the linear components on the True RMS Converter PCB. All adjustments are made with the 8810A's top guard cover removed. Adjustment locations are shown in Figure 609-4. If the 8810A is equipped with an Ohms Converter (Option -007), it should also be removed during this procedure and replaced after the procedure is compelte.

Table 609-1. AC Voltage Checks

VAC RANGE	AC INPUT VOLTAGE	FREQ IN Hz	DISPLAY LIMITS
2	0.10000	500	0.09880 to 0.10120
2	1.00000	500	0.99700 to 1.00300
2	1.00000	50k	0.99450 to 1.00550
20	10.0000	500	9.9700 to 10.0300
20	10.0000	50k	9.9450 to 10.0550
200	100.000	500	99.700 to 100.300
200	100.000	50k	99.450 to 100.550
750	500.00	500	498.00 to 502.00
750	500.00	50k	496.50 to 503.50

NOTE

Do not perform this procedure as part of the normal calibration routine. The adjustments given herein are one-time adjustments and will not have to be performed unless the True RMS Converter has undergone repair, or one or more of the following adjustments have been moved; R3, R28, R35, R36, and/or R41. See Figure 609-4.

1. Energize the 8810A and select the ACV function.
2. Depress the 20V range switch.
3. Connect a short circuit between the HI-LO INPUT terminals.
4. Connect dc voltmeter between TP1 and the LO INPUT terminal.
5. Adjust R3 for a dc voltmeter reading of 0.0 ±0.1 mV dc.
6. Connect the dc voltmeter between TP6 and the LO INPUT terminal.
7. Adjust R23 for a dc voltmeter reading of 0.00 ±0.05 mV dc.
8. Connect the dc voltmeter between TP5 and the LO INPUT terminal.
9. Adjust R28 for a dc voltmeter reading of 0.0 ±0.1 mV dc.
10. Connect a dc voltmeter between TP4 and the LO INPUT terminal.
11. Connect a jumper wire between TP3 and the LO INPUT terminal.
12. Connect an X1 oscilloscope probe to TP2. Use the LO INPUT terminal for the ground connection.
13. Set the scope for 200 mV/division sensitivity, 1 ms/division horizontal sweep, and dc coupling on the input amplifier.
14. Zero the scope and then adjust R35 on the True RMS Converter PCB for a 0V dc trace on the scope.

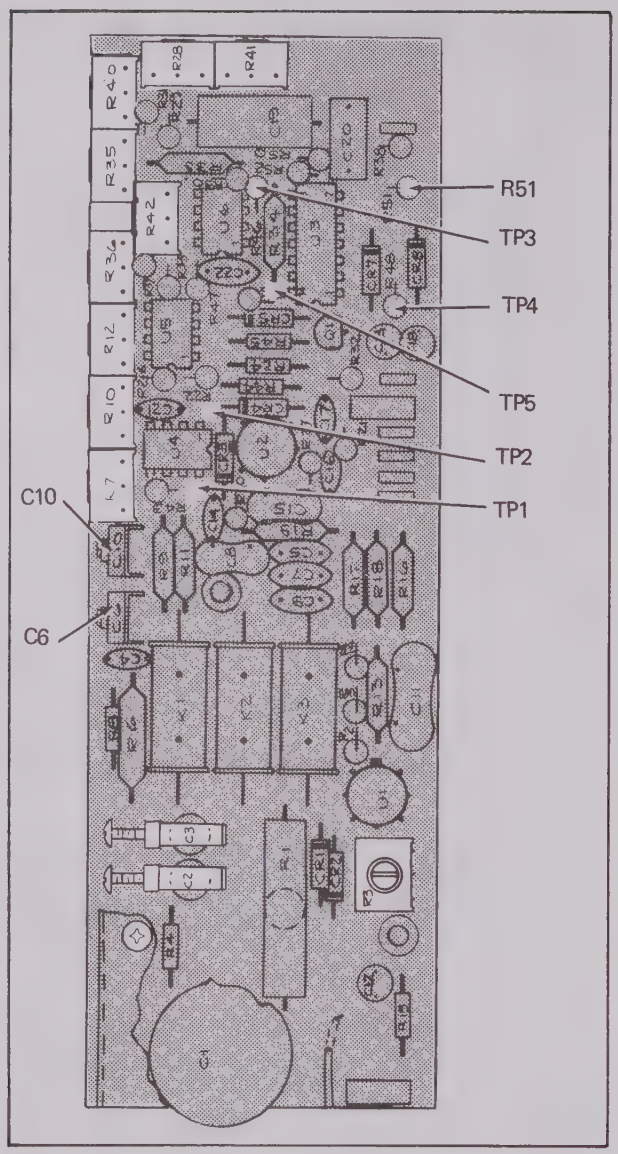


Figure 609-4. True RMS Converter Test Point and Adjustment Locations

15. Adjust R36 for a dc voltmeter reading between –0.82 and –0.87V dc.

16. Repeat steps 14 and 15 of this procedure until further adjustment is not required.

17. Remove the jumper wire connecting TP3 and the LO INPUT terminal.

18. Adjust R35 for a scope trace of 0V dc.

19. Note the reading on the dc voltmeter. Then adjust R36 clockwise until the reading is increased by 25 mV; e.g., if reading is –.943V adjust R34 for reading of –.968V.

20. Repeat steps 18 and 19 of this procedure until the dc voltmeter reading is between –.82 and –.87V dc at the end of step 19.

21. Disconnect the scope and dc voltmeter input connections at the 8810A. Also remove the short circuit between the HI-LO INPUT terminals.

22. Using an ac calibrator apply a 10V, 500 Hz signal to the 8810A HI-LO INPUT terminals.

23. Adjust R41 for an 8810A display reading between 9.9900 and 10.0100. Then adjust R40 for a reading of 10.0000 ±3 digits.

24. Reduce the calibrator output to 1V, 500 Hz.

25. Adjust R42 for a display reading of 1.0000 ±2 digits.

26. Repeat steps 22 through 25 of this procedure. However, adjust only R40 and R42. Do not adjust R41.

27. Perform the Range Adjustments procedure.

609-18. Range Adjustments

609-19. The following procedure is used to adjust the accuracy of each of the ac voltage ranges. All adjustments are made with the True RMS Converter's shield in place and with the 8810A top guard in place. Adjustment names given in this procedure agree with those silk-screened onto the top guard cover. The reference designator for each adjustment is given in parenthesis.

609-20. Sequentially, select the ac voltage ranges shown in Table 609-2 and use an ac calibrator to apply the indicated voltage/frequency for each range setting. As each input signal is applied, adjust the specified adjustment for an 8810A display reading within the limits shown.

609-21. LIST OF REPLACEABLE PARTS

609-22. A list of replaceable parts for the True RMS Converter PCB Assembly is given in Table 609-3. Refer to Section 5 of this manual for ordering information.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 609-2. AC Voltage Range Adjustments

VAC RANGE	AC INPUT VOLTAGE (RMS)	FREQUENCY IN Hz	ADJUSTMENT	DISPLAY LIMITS
2	1.00000	500	500V/500 Hz (R40)	.99997 to 1.00003
2	.10000	500	.1V/500 Hz (R42)	.09998 to .10002
2	1.00000	5000	500V/500 Hz (R40)	.99997 to 1.00003
2	.10000	500	.1V/500 Hz (R42)	.09998 to .10002
750	500.00	500	500V/500 Hz (R40)	499.98 to 500.02
750	500.00	50k	500V/50 Hz (C2)	499.70 to 500.30
2	1.00000	500	1V/500 Hz (R7)	.99997 to 1.00003
2	1.00000	50k	1V/50 kHz (C3)	.99970 to 1.00030
20	10.0000	500	10V/500 Hz (R10)	9.9997 to 10.0003
20	10.0000	50k	10V/50 kHz (C6)	9.9950 to 10.0050
200	100.000	500	100V/500 Hz (R12)	99.997 to 100.003
200	100.000	50k	100V/50 kHz (C10)	99.950 to 100.050

Table 609-3. True RMS Converter PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	TRUE RMS CONVERTER PCB ASSEMBLY (8810A-4024) FIGURE 609-4						
C1	CAP, CER, 0.1 UF -20/80%,500V	105684	56289	41C92	1		
C2	CAP, VAR, 0.25 TO .15 PF, 2000V	273151	72982	530-001	2	1	
C3	CAP, VAR, 0.25 TO .15 PF, 2000V	273151	72982	530-001	REF		
C4	CAP, CER, 4.7 PF +/-0.25 PF, 100V	36772	72982	8101-A100-C0G479G	3		
C5	CAP, CER, 0.01 +/-20%, 100V	149153	56289	C023B101F103M	3		
C6	CAP, VAR, 1.7 TO 10 PF, 250V	375238	52769	GKC10000	1	1	
C7	CAP, CER, 0.01 +/-20%, 100V	149153	56289	C023B101F103M	REF		
C8	CAP, MICA, 120 PF +/-5%, 500V	148486	72136	DM15F121J	1		
C9	CAP, CER, 0.01 +/-20%, 100V	149153	56289	C023B101F103M	REF		
C10	CAP, VAR, 5 TO 50 PF, 250V	404301	52769	GKC50000	1	1	
C11	CAP, MICA, 1500 PF +/-5%, 500V	148361	72136	DM19F152J	1		
C12	CAP, TA, 10 UF, +/-20%, 20V	330662	56289	196D106X0020KA1	3		
C13	CAP, TA, 10 UF, +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C14	CAP, CER, 4.7 PF +/-0.25 PF, 100V	36772	72982	8101-A100-C0G479G	REF		
C15	CAP, MICA, 390 PF +/-5%, 500V	148437	72136	DM15F391J	1		
C16	CAP, CER, 4.7 PF +/-0.25 PF, 100V	36772	72982	8101-A100-C0G479G	REF		
C17	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	3		
C18	CAP, TA, 10 UF, +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C19	CAP, POLYCARB, 1 UF +/-10%, 50V	271619	84411	X463UW1059.50W	1		
C20	CAP, POLYESTER, 0.22 UF +/-5%, 100V	436113	73445	C280MAH/A220K	1		
C21	CAP, CER, 100 PF +/-2%, 100V	369173	72982	8141-A100-G0G-101G	1		
C22	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
CR1	DIODE	375907	07263	FD7222	5	1	
CR2	DIODE	375907	07263	FD7222	REF		
CR3	DIODE	375907	07263	FD7222	REF		
CR4	DIODE	375907	07263	FD7222	REF		
CR5	DIODE	375907	07263	FD7222	REF		
CR7	DIODE, ZENER	246611	07910	1N961B	2	1	
CR8	DIODE, ZENER	246611	07910	1N961B	REF		
J5	CONNECTOR, FEMALE				1		
	PIN, LARGE	170480	74970	105-752	2		
	PIN, SMALL	375329	00779	85863-3	6		
K1	RELAY, REED, FORM A	357566	71707	UF40069	3		
K2	RELAY, REED, FORM A	357566	71707	UF40069	REF		
K3	RELAY, REED, FORM A	357566	71707	UF40069	REF		
MP1	SCREW, PH, SHIELD, 4-40 X 14	129890	73734	19022	1		
MP2	SHIELD	406280	89536	406280	1		
Q1	XSTR, SI, PNP	195974	04713	2N3906	1	1	
R1	RES, MF, 1M +/-0.1%, 1W	340265	03888	PME75	1		

Table 609-3. True RMS Converter PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R2	RES. COMP. 2.7M +/-5%. 1/4W	193490	01121	CB2755	5		
R3	RES. VAR. 100K +/-10%. 1/2W	369520	89536	369520	1	1	
R4	RES. COMP. 56K +/-5%. 1/4W	170738	01121	CB5635	1		
R5	RES. COMP. 2.4K +/-5%. 1/4W	193433	01121	CB2425	3		
R6	RES. MF. 995K +/-0.1%.1/4W	340158	91637	MFF1-49953B	1		
R7	RES. VAR. 10K +/-10%. 1/2W	285171	89536	285171	1	1	
R8	RES. COMP. 47K +/-5%. 1/4W	148163	01121	CB4735	1		
R9	RES. MF. 110.6K +/-0.1%. 1/8W	340224	91637	MFF1-8110R6B	1		
R10	RES. VAR. 1K +/-10%. 1/2W	285155	89536	285155	2	1	
R11	RES. MF. 10.05K +/-0.1%. 1/8W	340216	91637	MFF1-810R05B	1		
R12	RES. VAR. 100 +/-10%. 1/2W	285130	89536	285130	1	1	
R13	RES. MF. 1.001K +/-0.1%. 1/8W	340208	91637	MFF1-81001B	1		
R14	RES. COMP. 33 +/-5%. 1/4W	175034	01121	CB3305	2		
R15	RES. COMP. 22 +/-5%. 1/4W	147884	01121	CB2205	1		
R16	RES. MF. 20K +/-0.1%. 1/8W	340620	91637	MFF1-82002B	3		
R17	RES. MF. 20K +/-0.1%. 1/8W	340620	91637	MFF1-82002B	REF		
R18	RES. MF. 40K +/-0.1%. 1/8W	321489	91637	MFF1-84002B	1		
R19	RES. MF. 19.9K +/-0.1%. 1/8W	386334	91637	MFF1-81992B	1		
R20	RES. COMP. 100 +/-5%. 1/4W	147926	01121	CB1015	1		
R21	RES. COMP. 2.4K +/-5%. 1/4W	193433	01121	CB2425	REF		
R22	RES. COMP. 2.4K +/-5%. 1/4W	193433	01121	CB2425	REF		
R24	RES. COMP. 1.5K +/-5%.1/4W	148031	01121	CB1525	1		
R25	RES. COMP. 20K +/-5%. 1/4W	221614	01121	CB2035	3		
R26	RES. COMP. 2.7M +/-5%. 1/4W	193490	01121	CB2755	REF		
R27	RES. COMP. 20K +/-5%. 1/4W	221614	01121	CB2035	REF		
R28	RES. VAR. 100K +/-10%. 1/2W	288308	89536	288308	4	1	
R29	RES. COMP. 2.7M +/-5%. 1/4W	193490	01121	CB2755	REF		
R30	RES. COMP. 1.5K +/-5%.1/4W	148031	01121	CB1525	REF		
R31	RES. COMP. 1.5K +/-5%.1/4W	148031	01121	CB1525	REF		
R32	RES. COMP. 20K +/-5%. 1/4W	221614	01121	CB2035	REF		
R33	RES. COMP. 2.7M +/-5%. 1/4W	193490	01121	CB2755	REF		
R34	RES. MF. 20K +/-0.1%. 1/8W	340620	91637	MFF1-82002B	REF		
R35	RES. VAR. 100K +/-10%. 1/2W	288308	89536	288308	REF		
R36	RES. VAR. 100K +/-10%. 1/2W	288308	89536	288308	REF		
R37	RES. COMP. 75K +/-5%. 1/4W	220525	01121	CB7535	1		
R38	RES. COMP. 220K +/-5%. 1/4W	160937	01121	CB2245	1		
R39	RES. MF. 71.5K +/-0.25%. 1/8W	461467	91637	MFF1-87152C	1		
R40	RES. VAR. 1K +/-10%. 1/2W	285155	89536	285155	REF		
R41	RES. VAR. 20K +/-10%. 1/2W	291609	89536	291609	1	1	
R42	RES. VAR. 100K +/-10%. 1/2W	288308	89536	288308	REF		
R43	RES. COMP. 220K +/-5%. 1/4W	160937	01121	CB2245	REF		
R44	RES. COMP. 43K +/-5%. 1/4W	193367	01121	CB4335	2		
R45	RES. COMP. 10K +/-5%. 1/4W	148106	01121	CB1035	2		
R46	RES. COMP. 43K +/-5%. 1/4W	193367	01121	CB4335	REF		
R47	RES. COMP. 2.7M +/-5%. 1/4W	193490	01121	CB2755	REF		
R48	RES. COMP. 10K +/-5%. 1/4W	148106	01121	CB1035	REF		
R50	RES. COMP. 33 +/-5%. 1/4W	175034	01121	CB3305	REF		
R51	RES. COMP. 2.7 +/-5%. 1/4W	246744	01121	CB27G5	1		
R52	RES. COMP. 1.3 +/-5%. 1/4W	442012	01121	CB13G5	1		
U1	IC. OP AMP. FET INPUT	453357	02735	CA3140T	1	1	
U2	IC. OP AMP	472928	01295	TL080CL	1	1	
U3	XSTR ARRAY. NPN	445123	89536	445213	1	1	
U4	IC. OP AMP	418913	12040	LM4250CN	2	1	
U5	IC. DUAL OP AMP	418566	12040	LM358N	1	1	
U6	IC. OP AMP	418913	12040	LM4250CN	REF		

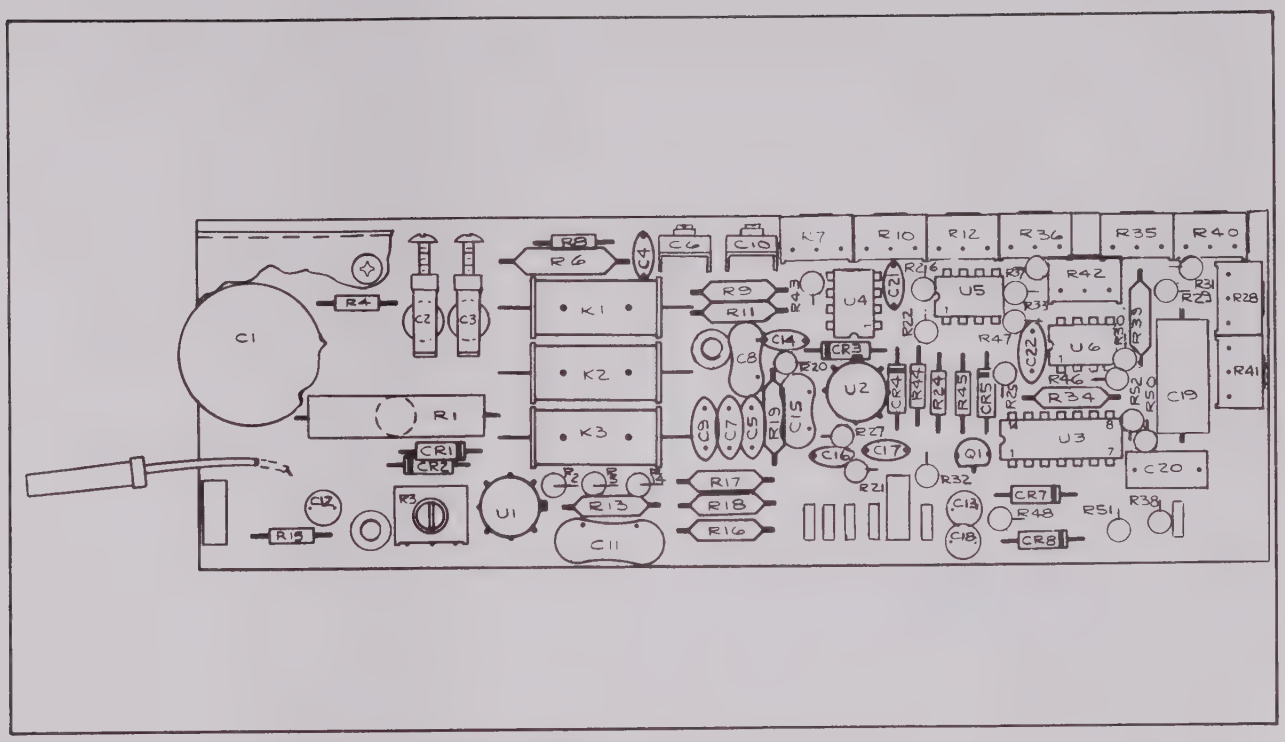


Table 609-3. True RMS Converter PCB Assembly (cont)

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5.

List of Abbreviations and Symbols

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
°C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
°F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^9)
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^3)
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^6)
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(–) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmablle read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisburg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884
Use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571
Use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
The Ross Milton Co.
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Div.
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, Massachusetts

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933
Use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

Federal Supply Codes for Manufacturers (cont)

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988
Use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, Minnesota

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp.
Rectifier Division
Hicksville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Div.
AMF Canada LTD.
Guelph, Ontario, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
The Budd Co. Polychem Products
Plastic Products Div.
Bridgeport, Pennsylvania

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606
Use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors,
formerly Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics
Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
GTE Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

Federal Supply Codes for Manufacturers (cont)

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Bucheye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co.
Corporate HQ
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
AB Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical
Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
P.R. Mallory & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp. formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, California

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnback Radio Co., Inc.
Freeport, New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village
Chicago, Illinois

72005
Wilber B. Driver Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

Federal Supply Codes for Manufacturers (cont)

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Bechman Instrument Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrance, California

73445
Amperex Electronic Corp.
Hicksville, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp.
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp.
Mepco Div.
A North American Phillips Co.
Norristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183
Use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Arnold Stevens, Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81483
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
The Carr Co., United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Div.
Eatontown, New Jersey

83330
Herman H. Smith, Inc.
Brooklyn, New York

83478
Rubbercraft Corp.
of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
John Fluke Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

Federal Supply Codes for Manufacturers (cont)

90201
Mallory Capacitor Co.
Div. of P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211
Use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737
Use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div. of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154
Use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts, Div. of
Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic
Hardware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect.
Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779
Use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

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Tempe, AZ 85282
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Tucson
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16969 Von Karman
Suite 100
Irvine, CA 92714
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John Fluke Mfg. Co., Inc.
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John Fluke Mfg. Co., Inc.
1980 South Quebec St. #4
Denver, CO 80231
(303) 750-1222

CT, Hartford
John Fluke Mfg. Co., Inc.
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41-C New London Turnpike
Glastonbury, CT 06033
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Orlando, FL 32803
(305) 896-4881

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John Fluke Mfg. Co., Inc.
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Marietta, GA 30067
(404) 953-4747

IA, Iowa City
(319) 354-2811

IL, Chicago
John Fluke Mfg. Co., Inc.
3740 Industrial Ave.
Rolling Meadows, IL 60008
(312) 398-0850

IN, Indianapolis
John Fluke Mfg. Co., Inc.
8777 Purdue Road
Suite 101
Indianapolis, IN 46268
(317) 875-7870

KS, Kansas City
(913) 381-9800

LA, New Orleans
(504) 455-0814

MA, Burlington
John Fluke Mfg. Co., Inc.
25 "B" Street
Burlington MA 01803
(617) 273-4674

MD, Baltimore
(301) 792-7060

Rockville
John Fluke Mfg. Co., Inc.
5640 Fishers Lane
Rockville, MD 20852
(301) 770-1570

MI, Detroit
John Fluke Mfg. Co., Inc.
33031 Schoolcraft
Livonia, MI 48150
(313) 522-9140

MN, Bloomington
John Fluke Mfg. Co., Inc.
1801 E. 79th St., Suite 9
Bloomington, MN 55420
(612) 854-5526

MO, St. Louis
John Fluke Mfg. Co., Inc.
2029 Woodland Parkway
Suite 105
St. Louis, MO 63141
(314) 993-3805

NC, Greensboro
John Fluke Mfg. Co., Inc.
1310 Beaman Place
Greensboro, NC 27408
(919) 273-1918

NJ, Paramus
John Fluke Mfg. Co., Inc.
P.O. Box 930
West 75 Century Road
Paramus, NJ 07652
(201) 262-9550

NM, Albuquerque
John Fluke Mfg. Co., Inc.
1108 Alvarado Drive N.E.
Albuquerque, NM 87110
(505) 881-3550

NY, Rochester
John Fluke Mfg. Co., Inc.
4515 Culver Road
Rochester, NY 14622
(716) 323-1400

OH, Cleveland
John Fluke Mfg. Co., Inc.
7830 Freeway Circle
Middleburg Heights, OH 44130
(216) 234-4540

Columbus
(614) 889-5715

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John Fluke Mfg. Co., Inc.
4756 Fishburg Rd.
Dayton, OH 45424
(513) 233-2238

OK, Tulsa
(918) 749-0190

OR, Portland
John Fluke Mfg. Co., Inc.
2700 NW 185th
Suite 2080
Portland, OR 97229
(503) 629-5928

PA, Philadelphia
John Fluke Mfg. Co., Inc.
1010 West 8th Ave., Suite H
King of Prussia, PA 19406
(215) 265-4040

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(412) 261-5171

TX, Austin
(512) 459-3344

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Dallas, TX 75234
(214) 233-9990

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John Fluke Mfg. Co., Inc.
4240 Blue Bonnet Dr.
Stafford, TX 77477
(713) 491-5995

San Antonio
John Fluke Mfg. Co., Inc.
10417 Gulfdale
San Antonio, TX 78216
(512) 340-2621

UT, Salt Lake City
6914 So. 3000 East
Suite 206
Salt Lake City, UT 82021
(801) 268-9331

WA, Seattle
John Fluke Mfg. Co., Inc.
5020 148th Ave. N.E.
Suite 110
Redmond, WA 98052
(206) 881-6966

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CA, Santa Clara (408) 727-8121
CO, Denver (303) 750-1228
FL, Orlando (305) 896-2296
IL, Chicago (312) 398-5880
MA, Burlington (617) 273-4678
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TX, Dallas (214) 233-9945
WA, Everett (206) 356-5560

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Concord, N.S.W. 2137
Australia
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Mt. Waverly, Victoria 3149
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Tel: (8) 271-1839

Elmeasco Instruments Pty, Ltd.
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Gosnells, West Australia 6110
Australia
Tel: (9) 398-3362

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Gerate GmbH & Co.
Vertrieb KG
Obachgasse 28
1220 Vienna, Austria
Tel: (222) 235555, TLX: (847) 134759

Bangladesh ●
Motherland Corporation
24 Hatkhola Road, Tikatuli
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6 Rue de Geneve
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Coasin Bolivia S.R.L.
Casilla 7295
La Paz, Bolivia
Tel: (2) 40962, TLX: (336) 3233

Brazil ●
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Comercio Ltda.
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CEP 06400, Sao Paulo, Brazil
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Av. Henrique Valadares, No. 23/401
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Tel: (21) 252-1297

Brunei ●
Rank O'Connor's Berhad, Ltd.
No. 8 Block D Sufri Complex
Mile 1 Jalan Tutong
Bandar Seri Begawan
Negara Brunei Darussalam
Tel: (2) 23109 or 23557
TLX: (799) BU2265 RANKOC

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Tel: (416) 678-1500, TLX: 06968769

Allan Crawford Assoc., Ltd.
7018 Cote de Liesse
St. Laurent, Quebec
H4T 1E7 Canada
Tel: (514) 731-8564, TLX: 05824944

Allan Crawford Assoc., Ltd.
881 Lady Ellen Place
Ottawa, Ontario
K1Z 5L3 Canada
Tel: (613) 722-7682, TLX: 0533600

Allan Crawford Assoc., Ltd.
Suite 106
4180 Lougheed Hwy.
Burnaby, British Columbia
V5C 6A8 Canada
Tel: (604) 294-1326, TLX: 0454247

Allan Crawford Assoc., Ltd.
1935 30th Avenue, N.E.
Calgary, Alberta
T2E 6Z5 Canada
Tel: (403) 230-1341, TLX: 03821186

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Intronica Chile, Ltda.
Manuel Montt 024-Of.D
Casilla 16228
Santiago 9, Chile
Tel: (2) 44940, TLX: (332) 240301

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Appendix 7A
Manual Change Information

INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual with an X.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

CHANGES

There are no backdating changes at this printing. All pcb assemblies are documented at their original revision level.

Table 7A-1. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	* To adapt manual to earlier rev configurations perform changes in desending order (by no.), ending with change under desired rev letter																					
			A	B	C	D	E	F	G	H	J	K	L	M	N	P	U							
A1	Main PCB Assembly	366245	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	X							
A2A1	Display PCB Assembly	366278	▒	▒	▒	▒	X																	
–002	Digital Output Unit PCB Assembly	366369	▒	▒	▒	▒	▒	X																
–007	AC Converter PCB Assembly	462846	X																					
–008	Ohms Converter PCB Assembly	456103	▒	X																				
–009	True RMS Converter PCB Assembly	472449	X																					

***x = The PCB revision levels documented in this manual.**
▒ = These revision letters were never used in the 8810A.

Section 8
Schematic Diagrams

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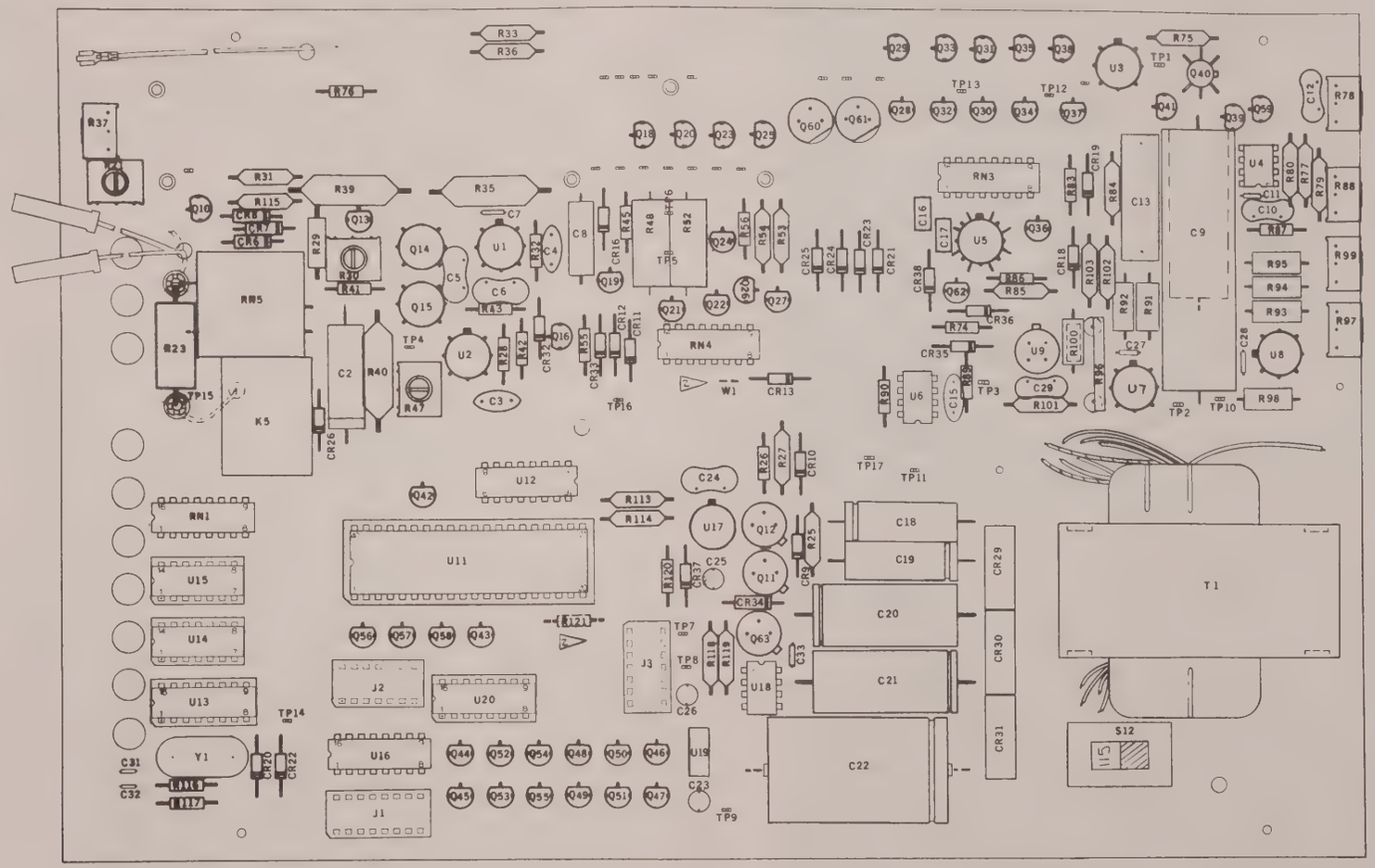
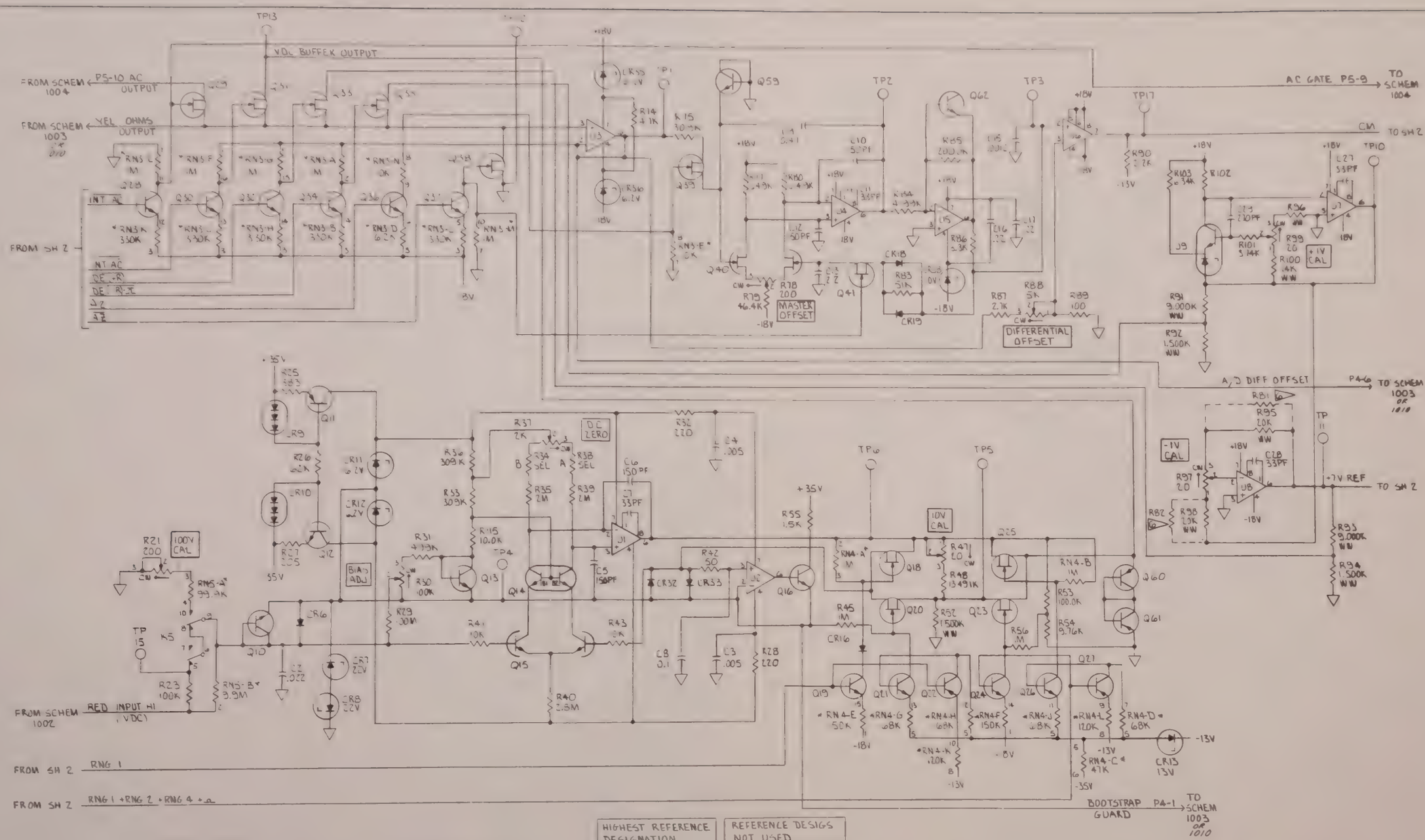
Table 8-1. Mnemonics

INT	INTEGRATE
+R	Voltage Reference, Positive
−R	Voltage Reference, Negative
DE	Read Period (Deintegrate)
△2	1 Millisecond Settling Period
AZ	Auto Zero Period
CM	Compare
AC	AC Volts Function
β	Low Range Command (Input to U11)
Ω	Ohms Function
∝	High Range Command (Input to U11)
DC	DC Volts Function
F	1 MHz Clock Frequency
W-X-Y-Z	(8-4-2-1) Character Serial Display Data
a-b-c	(4-2-1) Range Code
A thru G	Display Segment Bus (See A2A1 Display PCB Schematic)
OL or Ω	Overload
RNG1 thru RNG5	Range Commands for selected function
ST1 thru ST6	Strobe 1 through Strobe 6 for range control (manual and auto range)
DS1 thru DS6	Data Strobe 1through Data Strobe 6 to Display PCB LEDs



8800A-1201

Figure 8-1. A1 Main PCB Assembly


VDC BUFFER OUTPUT
FROM SCHEM 1004 ← PS-10 AC OUTPUT
FROM SCHEM 1003 ← YEL OHMS OUTPUT
FROM SH 2
INT AC
QE (-R)
DE (-R)
AC GATE PS-9 → TO SCHEM 1004
CM → TO SH 2
MASTER OFFSET
DIFFERENTIAL OFFSET
A/D DIFF OFFSET → P4-6 TO SCHEM 1003 OR 1010
+7V REF → TO SH 2
-1V CAL
+1V CAL
10V CAL
100V CAL
DC ZERO
BIAS ADJ
FROM SCHEM 1002 RED INPUT HI (VDC)
FROM SH 2 RNG 1
FROM SH 2 RNG 1 +RNG 2 +RNG 4 +a
BOOTSTRAP GUARD P4-1 → TO SCHEM 1003 OR 1010
-13V
-18V
-35V

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE VALUES IN OHMS
2. ALL CAPACITANCE VALUES IN MICROFARADS
3. CONNECT -13V TO U11-1, -12, -13 & -14, U12-16, U13-1 & -16, U14-14, U15-14, U16-16, U20-16.
4. CONNECT -18V TO U11-4, -8 & -36, U12-8 & -12, U13-8, U14-7, U15-7, U16-8, U20-6, -7 & -8.

FACTORY SELECTED.

HIGHEST REFERENCE DESIGNATION		
C33	CR39	K5
Q63	R1Z1	S1Z
T1	TP17	U20
Y1		

REFERENCE DESIGS NOT USED
C1, 14, 30.
CR1-5, 14, 15, 17, 27, 28.
K1-4, Q1-9, 17, 42
R1-20, 22, 24, 44, 46, 49-51, 57-73, 76, 104-116, 51-10. U10.

88001A-1001
(Sheet 1 of 2)

Figure 8-1. A1 Main PCB Assembly (cont)

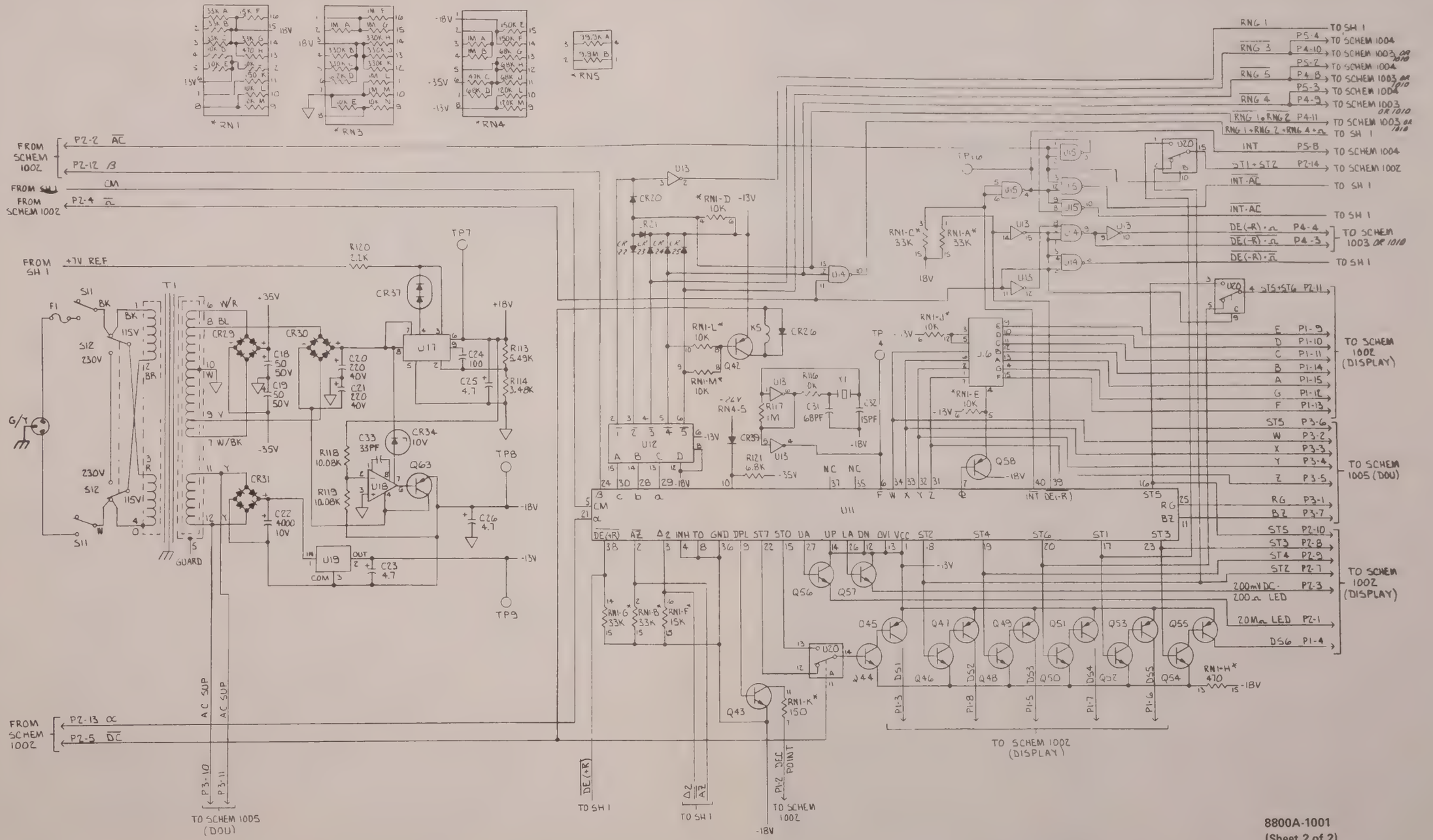


Figure 8-1. A1 Main PCB Assembly (cont)

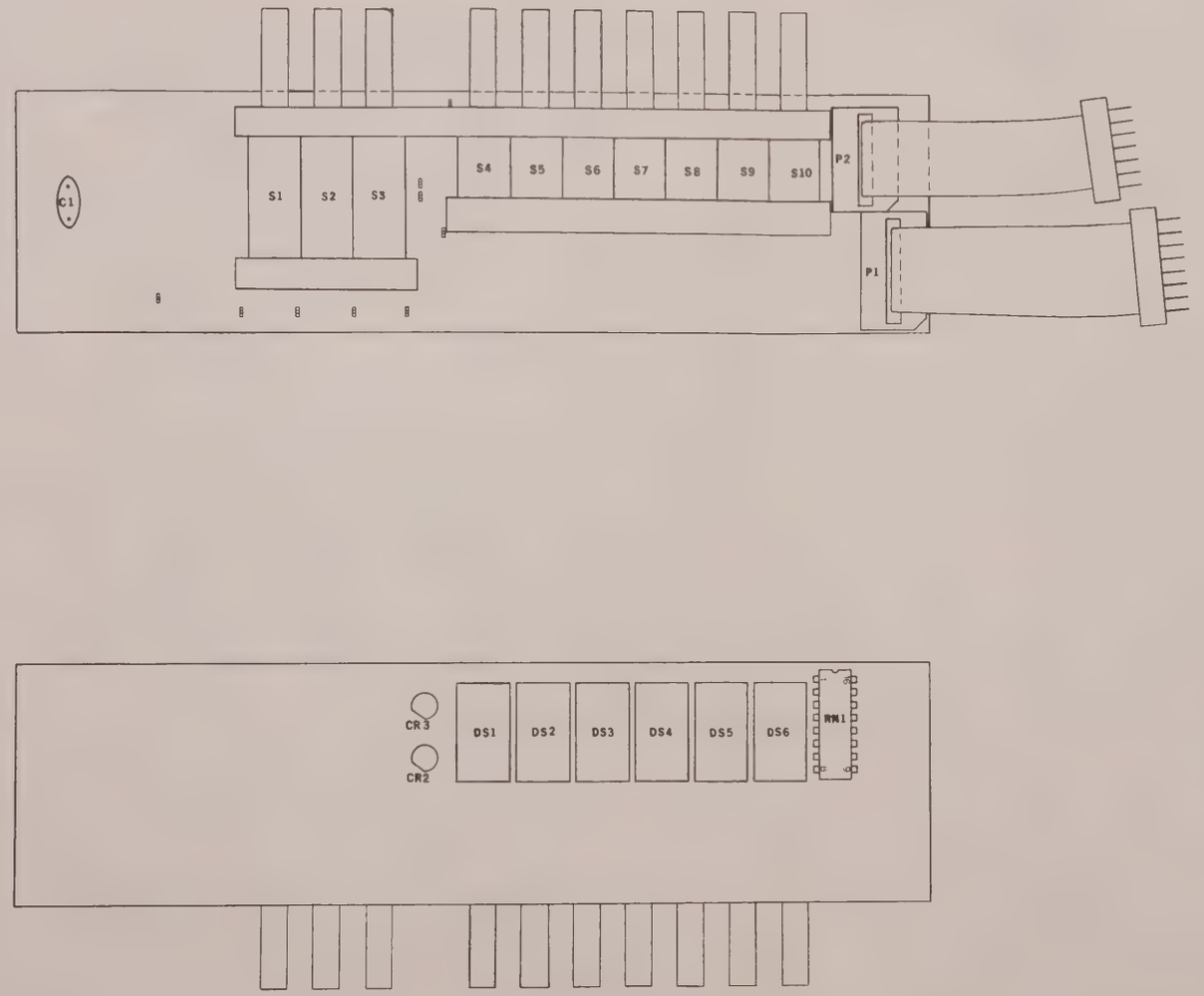


Figure 8-2. A2A1 Display PCB Assembly

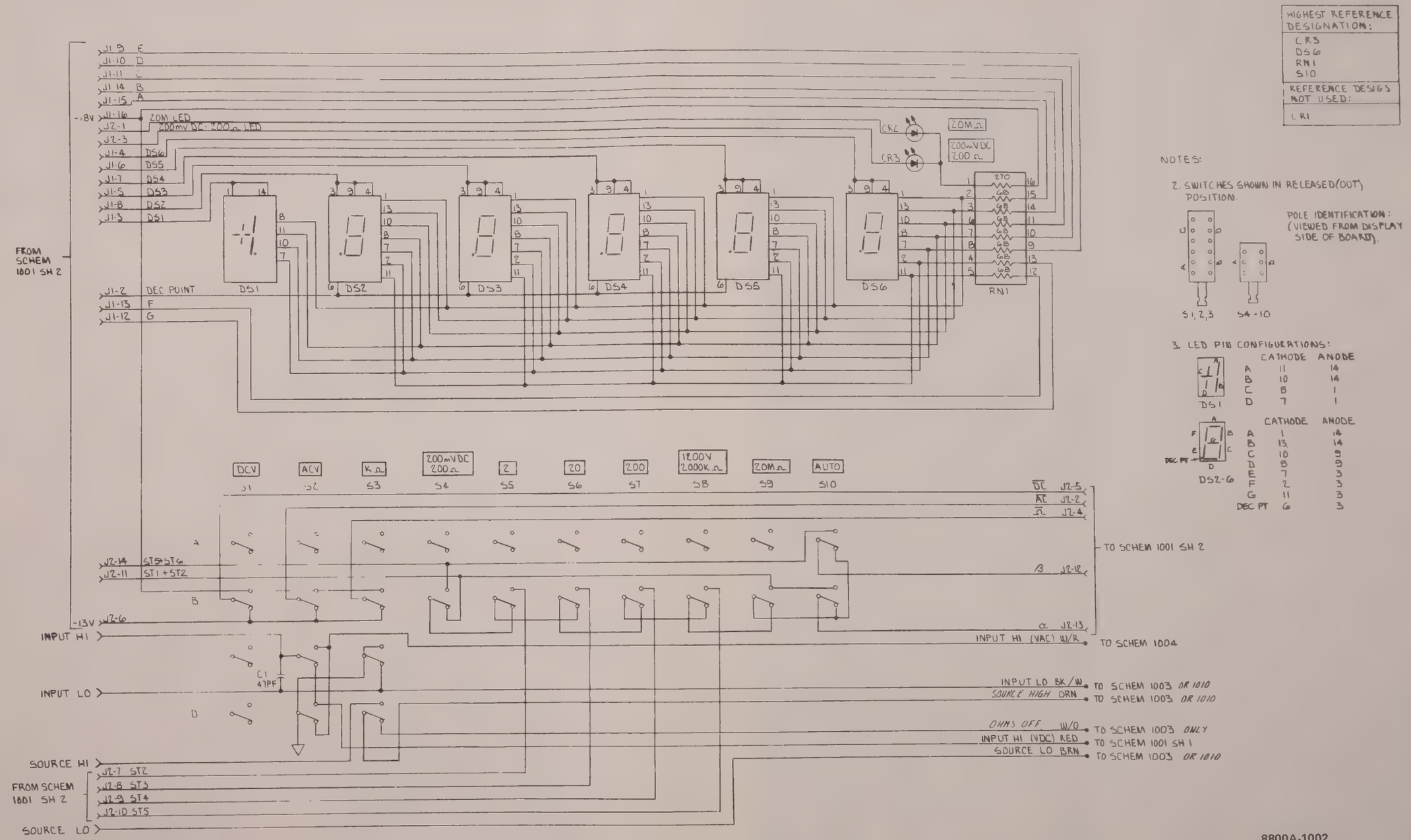
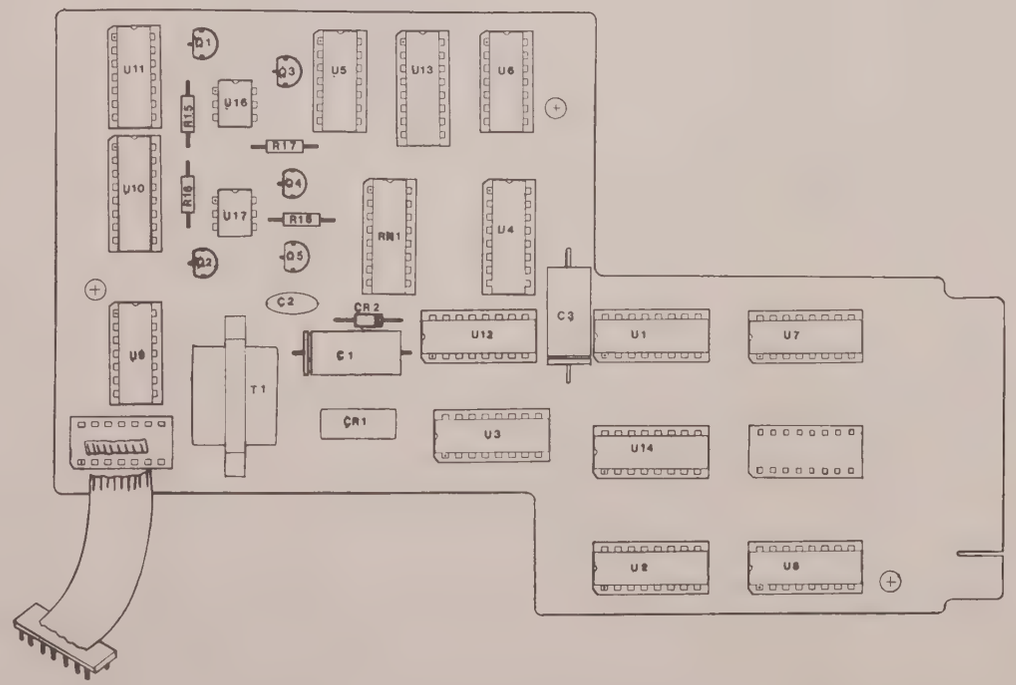
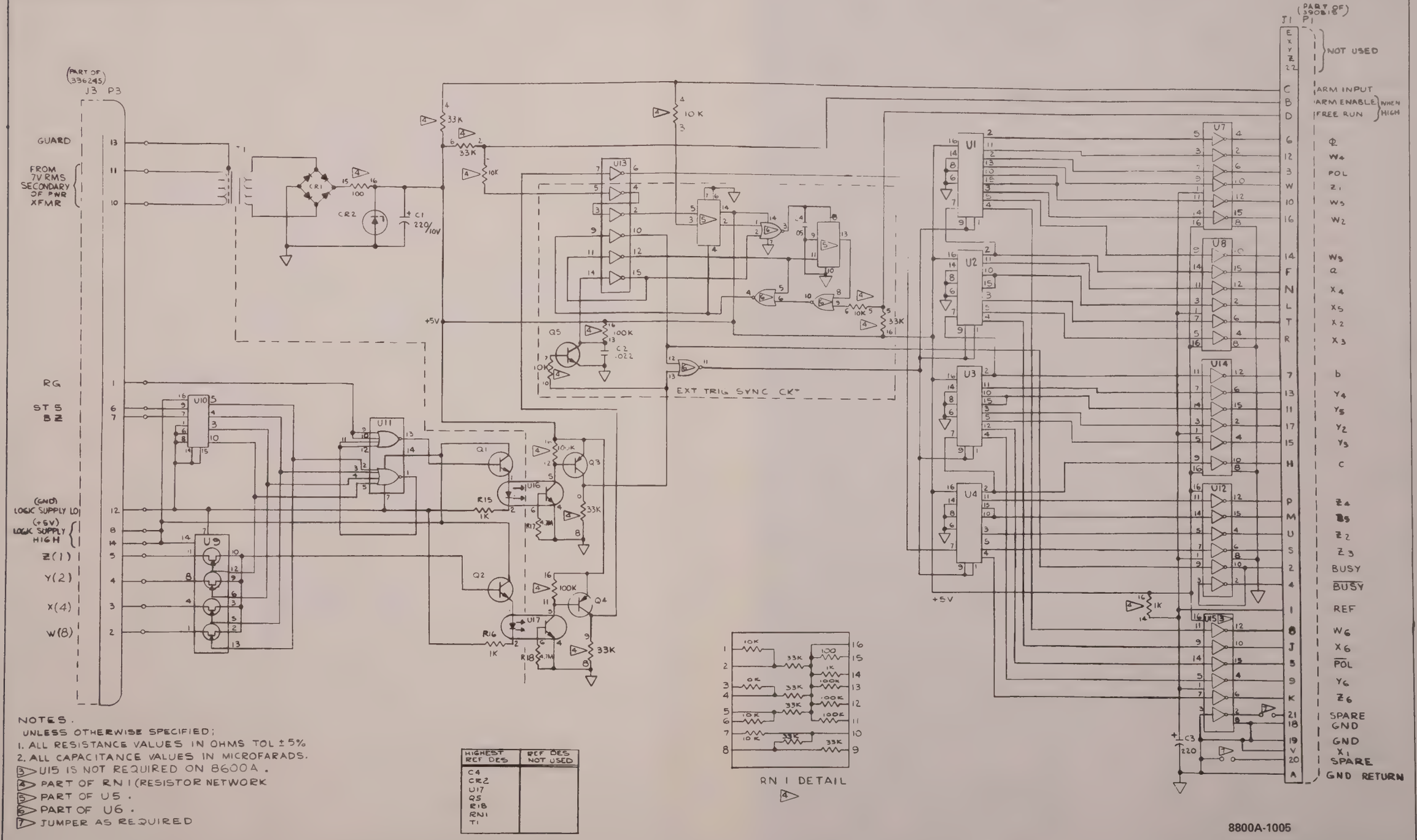


Figure 8-2. A2A1 Display PCB Assembly (cont)



8800A-1205

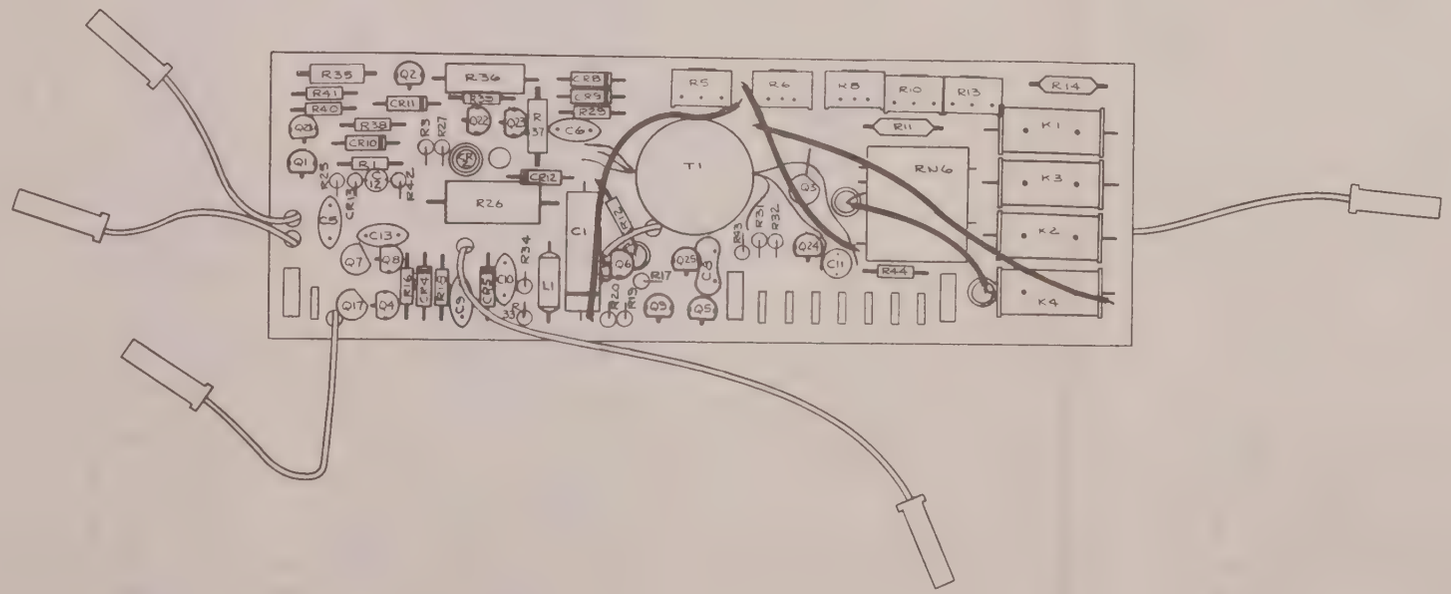
Figure 8-3. —002 Option, DOU PCB Assembly



NOTES.
UNLESS OTHERWISE SPECIFIED;
1. ALL RESISTANCE VALUES IN OHMS TOL ± 5%
2. ALL CAPACITANCE VALUES IN MICROFARADS.
3. U15 IS NOT REQUIRED ON 8600A.
4. PART OF RN 1 (RESISTOR NETWORK
5. PART OF U5.
6. PART OF U6.
7. JUMPER AS REQUIRED

HIGHEST REF DES	REF DES NOT USED
C4	
CR2	
U17	
Q5	
R18	
RN1	
T1	

Figure 8-3. –002 Option, DOU PCB Assembly (cont)



8800A-1610

Figure 8-4. –007 Option, Ohms Converter PCB Assembly

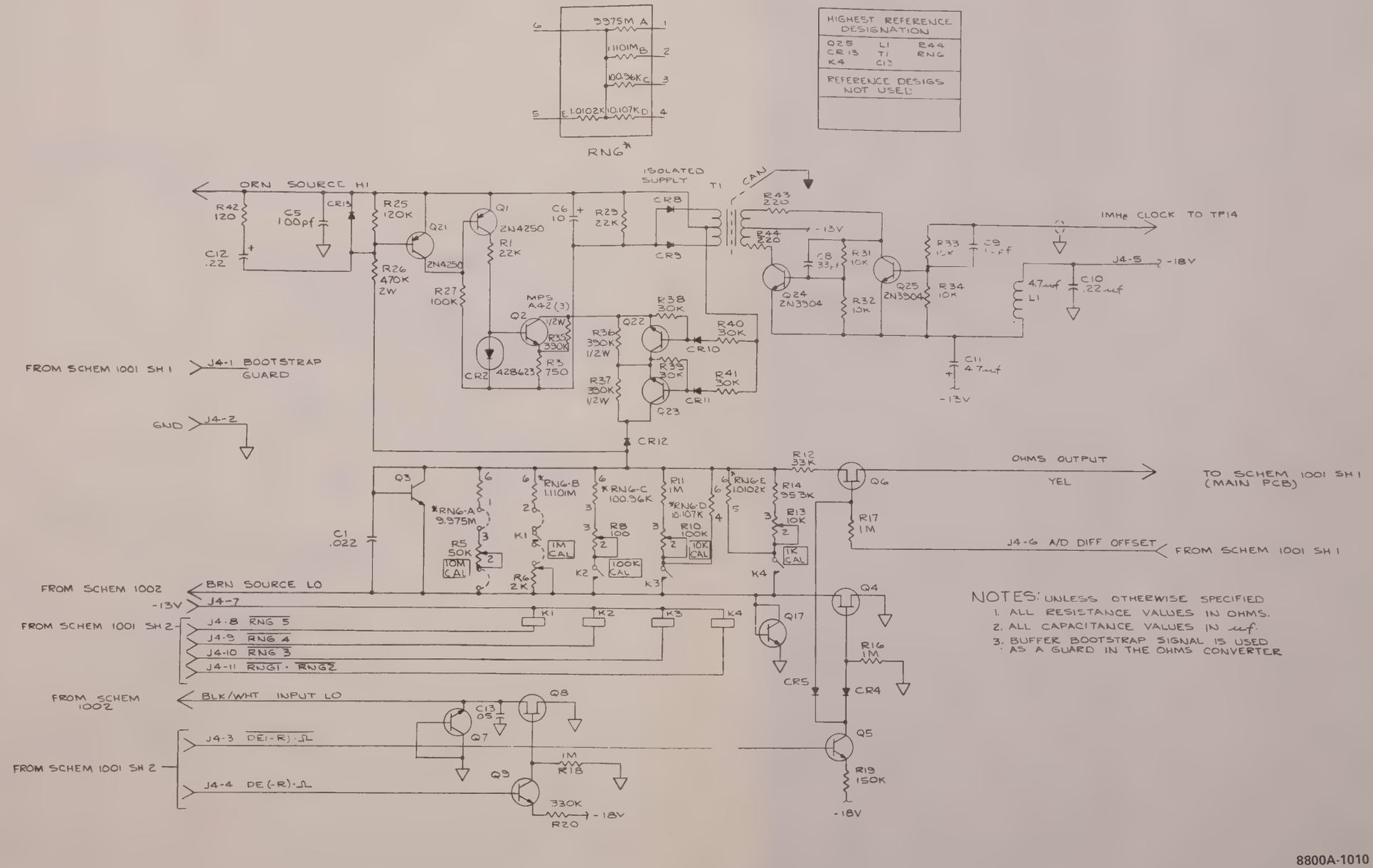
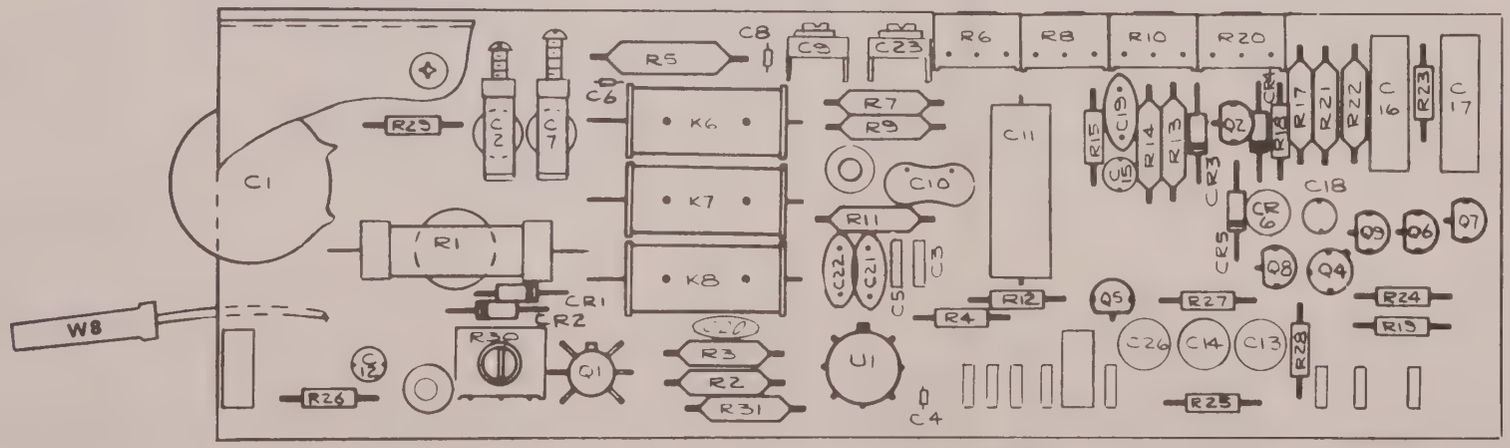
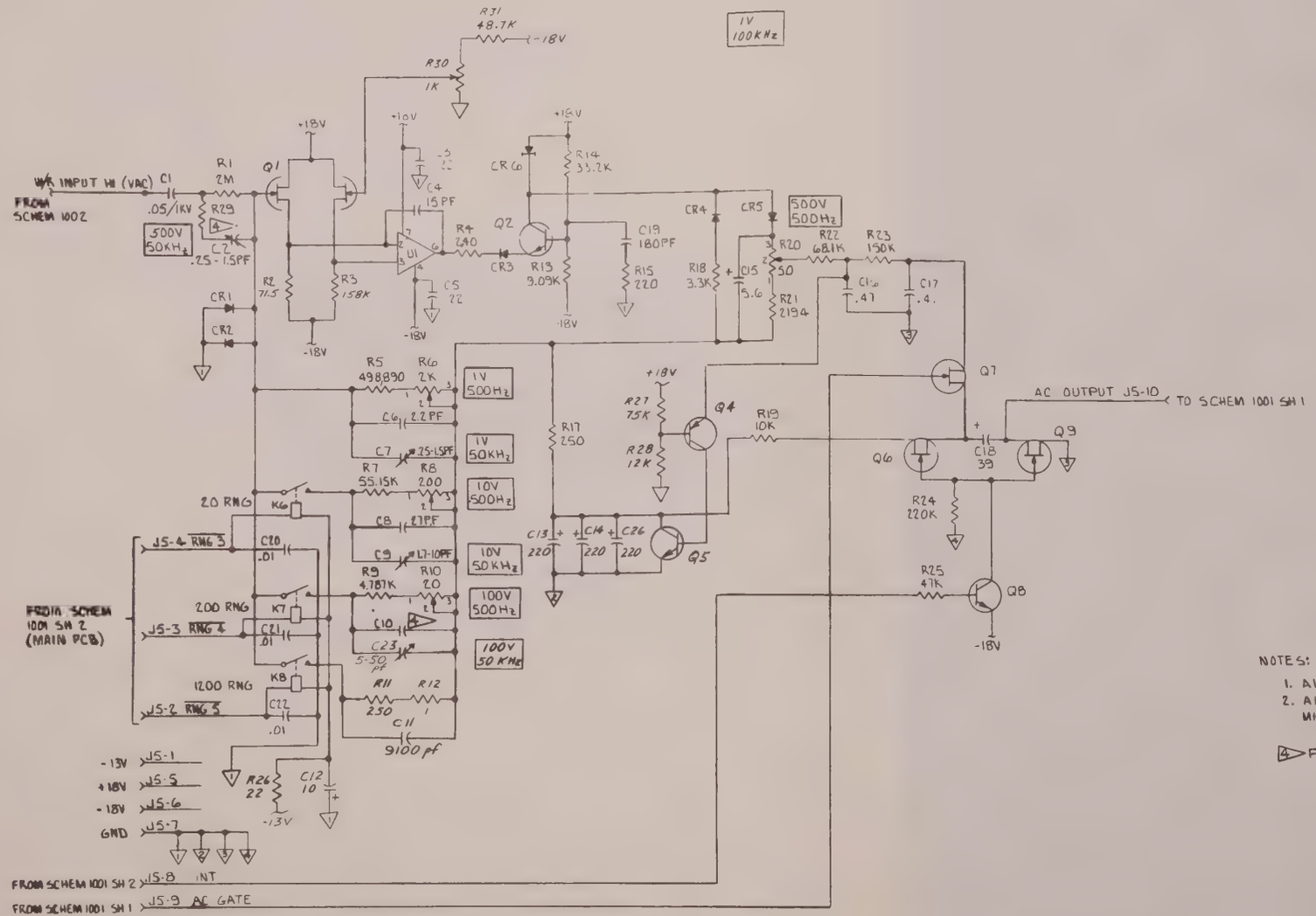


Figure 8-4. –007 Option, Ohms Converter PCB Assembly (cont)



8810A-1614

Figure 8-5. –008 Option, AC Converter PCB Assembly



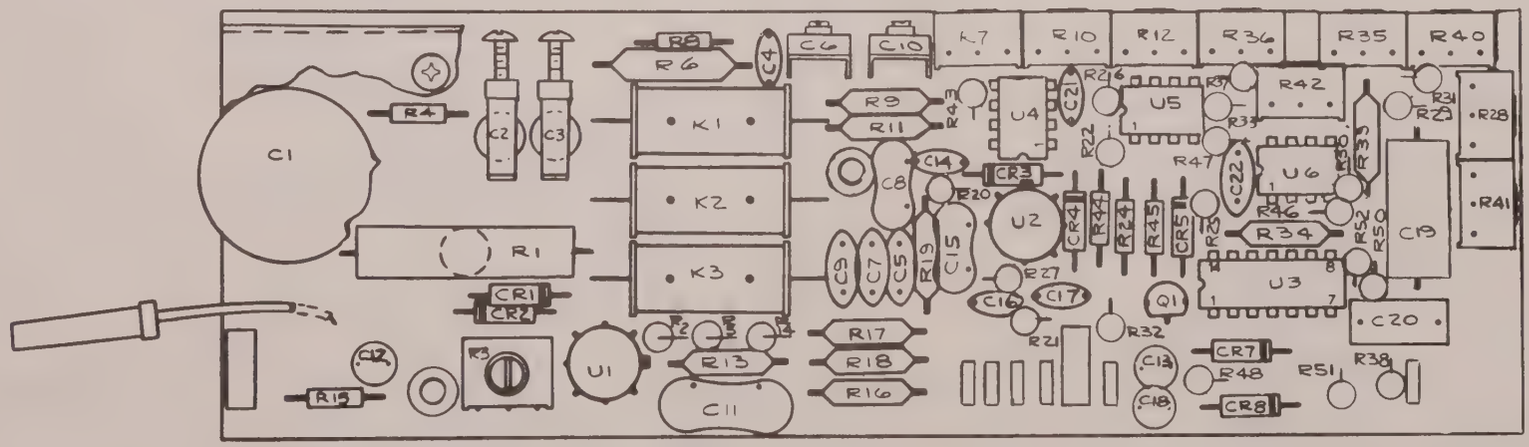
NOTES: UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.

4 FACTORY SELECTED COMPONENTS:
R29 = 4.7K NOMINAL
C10 = 390 PF NOMINAL

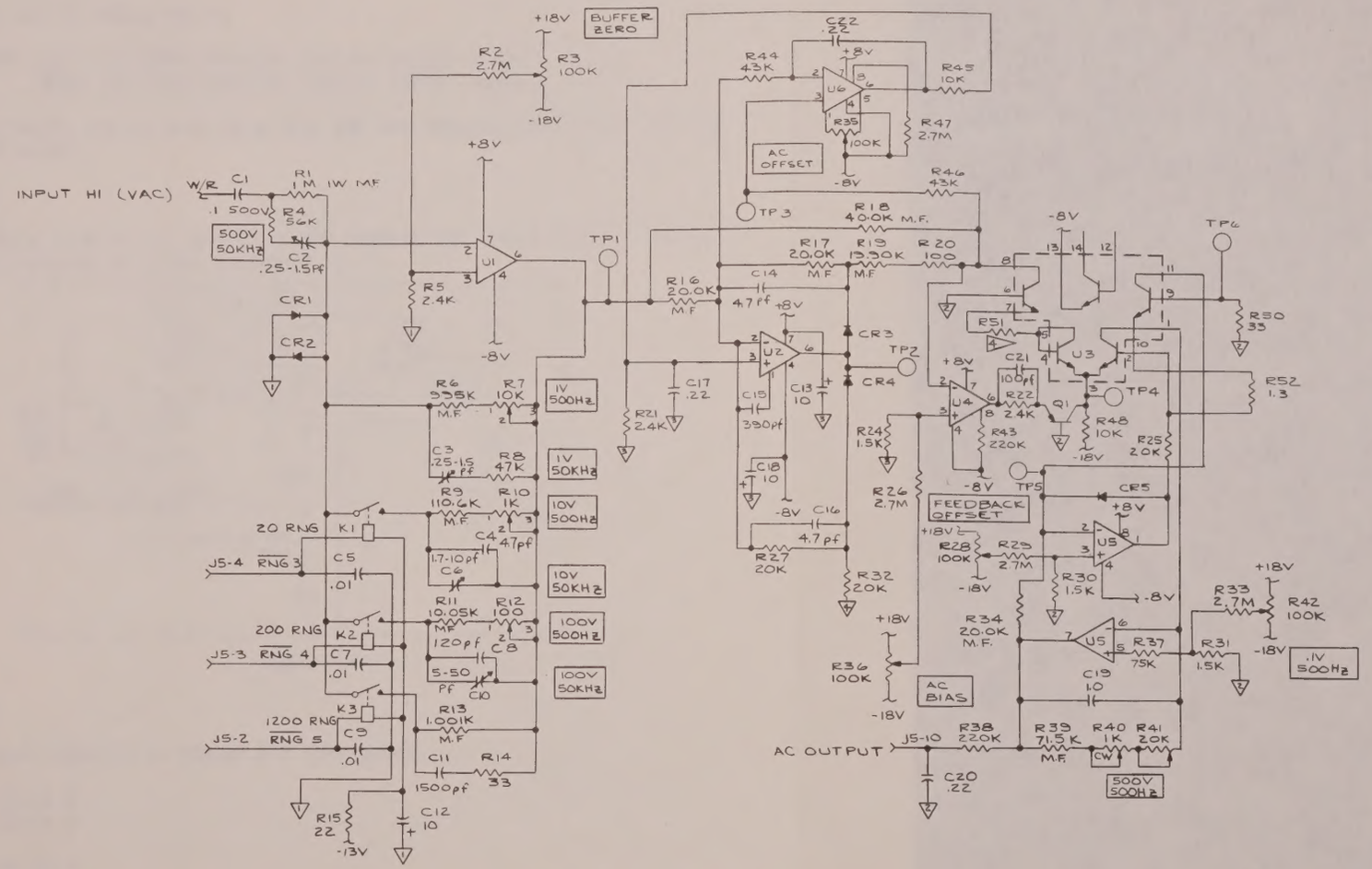
8810A-1014

Figure 8-5. –008 Option, AC Converter PCB Assembly (cont)



8810A-1624

Figure 8-6. –009 Option, RMS Converter PCB Assembly (cont)



NOTES:- UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.

4 FACTORY SELECTED COMPONENT
RS1 = 2.7Ω NOMINAL

CAUTION
SUBJECT TO DAMAGE BY STATIC ELECTRICITY

8810A-1024

Figure 8-6. –009 Option, RMS Converter PCB Assembly (cont)

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